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OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

1. Pescadito . . . it's Texas' deepest salt dome. F. J. Gardner. *Oil Gas J.*, 1.7.57, **55** (26), 189.—1 Killam in Webb County, S. Texas, a test for the Edwards limestone, found salt at *ca* 14,000 ft and proved the deepest known salt core in Texas. Gas was found in the L. Cretaceous Georgetown at 12,900 ft, but the Edwards was not penetrated. A map shows the depths of salt domes in S. Texas. C. A. F.

2. A history of Southwestern pay formations. F. E. McGonagill. *Oil Gas J.*, 1.7.57, **55** (26), 190.—The main pays of Arkansas, New Mexico, Mississippi, and Louisiana are listed, showing their relative importance, and tables are included showing the number of fields producing from these pays, proved acreage, production, oil gravity, average net pay thickness, and recovery data. C. A. F.

3. San Juan basin rim area. H. Budd. *World Oil*, 1957, **145** (2), 45.—Although the San Juan basin in New Mexico has had known gas reserves for many years, there had been little oil production until some recent discoveries which indicate that the area may prove to be a major oil province.

The basin contains up to *ca* 15,000 ft of beds, and includes at least 6000 ft of Upper Cretaceous in which the recent oil discoveries have been found. These produce from stratigraphic traps in the Gallup sandstone, a series of sand bars equivalent to the Niobrara. These bars are long and narrow lenses, and they have been found productive in the Dogie Canyon, and Verde–Gallup fields, and also in the Horseshoe

Canyon and Bisti areas. These fields are stratigraphical traps, and current exploration in the area is concentrated in the search for offshore sand bars which are sub-parallel to the regional strike. Porosities and permeabilities tend to be low, and fracture treatment is commonly used.

Oil is of good quality, and 2 major pipelines are planned to provide an outlet for the potential production from the area. C. A. F.

4. Bois d'Arc pay spurs limestone exploration. Pt 2. E. Barrett and E. F. Culp. *Oil Gas J.*, 10.6.57, **55** (23), 172.—There are 3 groups of fields which produce from the Hunton Bois d'Arc limestone in central Oklahoma, located as follows: (1) along the regional truncation line of the Bois d'Arc limestone; (2) down-dip from the line of regional truncation; and (3) in buried outliers or erosional remnants of Bois d'Arc limestone up-dip from the line of truncation. Most of the fields found so far are in the first group, typified by W. Edmond and Short Junction fields, which are briefly described. Examples of fields in the other groups are also given, together with tables listing details of all the fields producing from the Bois d'Arc limestone. A series of photomicrographs shows the nature of the pay; the limestone is almost pure calcite, and there is evidence of intergranular and secondary porosity.

Drilling, completion, and production practices are briefly outlined. C. A. F.

5. Virden reserves top 30,000,000 brl. C. A. Berg. *Oil Gas J.*, 8.7.57, **55** (27), 186.—The geology of the Virden–Roselea and N. Virden fields in Manitoba is described. They were found in 1953 and there are now *ca* 400 producing wells. The fields are still under development, Virden–Roselea having produced over 3 million brl, and N. Virden over 2,600,000 brl. Estimated recoverable reserves are, respectively, 11 million brl and 20 million brl.

Pays are in the Mississippian Lodgepole, at *ca* 2000 ft, and are mainly clastic limestones. Accumulations are controlled partly by structure and partly by stratigraphical trapping.

Secondary processes affecting porosity and permeability in the reservoir rocks are discussed. The pays are overlain unconformably by the Jurassic, and leaching took place during the erosion period. Following the Jurassic transgression, the limestone beneath the unconformity was replaced by secondary dolomite, and there was infilling by anhydrite. The effects of these processes are described. Diagrams show the structure of the fields and comparisons of porosity and permeability in leached and unleached limestone. 3 refs. C. A. F.

6. Outline of the sedimentary basins in North-East Poland. Z. Olewicz. *Bull. Polish Inst. Petrol.*, 1956, **6**, 11 (Suppl. *Nafta (Krakow)*, 1956, **12**).—Work done so far permits the location of sedimentary basins on the Polish–Lithuanian border. There are indications of the existence of a shelf which extends as far as the St Cross mountains. M. S.

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

7. New tools for the geophysicist. Anon. *World Petrol.*, 1947, **28** (3), 67.—Recent developments in the application of electronics to the gathering, storage, and interpretation of geophysical data are briefly outlined, together with a few recent surveying techniques. There has been increasing use of magnetic recording, and office equipment is in use involving automatic velocity computation and corrections to the datum plane, weathering, and step-out. The cross-section method of presenting seismic data has proved of great interest, and a number of improvements in detectors have been announced. 3 recent surveying developments are the Marine Sonoprobe, improved weight-dropping techniques, and the Dumont multiplier phototube, which can be used in radioactivity logging to measure γ-ray spectra. C. A. F.

8. Field techniques and problems in offshore gravity programme. V. M. Lynch. *World Petrol.*, 1957, **28** (3), 65.—A gravity exploration project in the Gulf of Mexico is described. It is the largest offshore gravity survey yet carried out and is covering an area between Sabine Pass, Texas, and New Orleans. The work is being carried on from a network of land bases along the coast out to a water depth of 120 ft.

Observations involve the use of electronic surveying and remote-controlled underwater meters and pressure gauges.

Problems of positioning and transport are outlined, together with details of surveying procedure. A map shows the area of the project. C. A. F.

9. Central office processing of office data. H. J. Jones. *World Petrol.*, 1957, **28** (3), 68.—Advantages of processing seismic data in a central office are discussed. The procedure gives increased flexibility, enabling the data to be replayed through the analysis equipment as required to obtain the optimum combination of parameters. Details of procedures are given, and an analogue seismic data-processing system, the Seismac, is described in detail. It was designed for flexibility, compatible with a wide variety of magnetic recording equipment, minimum wave-form distortion when required, and the ability to prepare a corrected record for subsequent trace mixing and shot compositing. It is essentially a programmed time-delay unit.

The end product of the central office is a set of records which can be assembled into cross-sections, or composite cross-sections prepared by special cameras. 3 refs. C. A. F.

10. Carter oil laboratories develop field and office magnetic machines. Anon. *World Petrol.*, 1957, **28** (3), 74.—Research into a means for obtaining a permanent reproducible tape recording of a seismic shot, together with the office playback equipment required to reduce the data on the field records and present them in the most effective form for interpretation has led to the development of the FR-1/MT-4 Field Recorder and Office Playback Machine, which are described. The field recorder amplifies and records 24 traces of seismic signals. The MT-4 playback machine corrects for weathering and elevation (for each trace), and for normal move-out. Up to 4 tapes can be time-corrected and then added in the required mix programme. A drum-oscillograph is included which can trace record cross-sections with up to 250 traces on paper 16 inches wide. C. A. F.

11. Marine Sonoprobe: a new seismic system for the study of recent sediments. Anon. *World Petrol.*, 1957, **28** (3), 60.—Samples of bottom sediment provide useful data on processes of sedimentation, but do not enable adequate stratigraphic information on recent sediments to be obtained. A tool known as the Marine Sonoprobe was therefore developed for this purpose.

The tool behaves like a small reflecting seismograph emitting sound pulses of approx 4000 c.p.s. generated at approx 12 per sec. The sound waves are propagated through water into the sediments and reflected back by interfaces to a receiver. The result is a profile of the sea floor, together with the underlying beds, to a max depth of 175–200 ft below the floor. Penetration of this amount is exceptional, and generally the depth of penetration is a function of the acoustical properties of the sediments in a particular area. The device has been operated in the Gulf of Mexico, off California, and in Venezuela. Satisfactory results have been obtained in water depths over 1000 ft with a boat speed of 4–6 knots.

It has many potential uses in geology and geophysics and examples of record profiles are given. C. A. F.

12. SIE record-analysis system. Anon. *World Petrol.*, 1957, **28** (3), 72.—An integrated seismic record-analysis system using 3 machines is under development. The first of the units is the SIE MR-12, which is used mainly for correcting records for weathering and elevation. It will also produce cross-sections in the form of pen records. The second machine will be used for high-speed compositing of seismic records, and the third will be a record plotter for converting field tapes into depth sections.

Details of the equipment are given with " flow sheets " of the systems. C. A. F.

13. SSC seismic replay centre. Anon. *World Petrol.*, 1957, **28** (3), 71.—The SSC seismic replay centre, which has been designed for the complete analysis of seismic data, is briefly described. The data is reproduced from magnetic-tape field recordings, and the equipment consists of 3 main units: replay console, visual-display unit, and cross-section camera. Field tapes are corrected for weathering, elevation, and normal step-out, and are then composited and filtered to give the optimum reflection to noise ratio. The signal traces can then be recorded by a conventional camera as variable-amplitude traces, or re-recorded for storage or presentation as a variable-density cross-section using the cross-section camera. C. A. F.

14. Geopac: an automatic plotter and computer for seismic geophysical data. L. M. Mott-Smith, W. J. Gundlach, and G. C. Phillips. *World Petrol.*, 1957, **28** (3), 76.—An automatic device for processing seismic data, the Geopac, has recently been developed, and its operation and uses are described. Basic data (velocities, elevation, distances, and first arrivals) are fed into the computer, and a tape recording of the seismic signals is placed on a magnetic drum. Servo-positioned heads read from the magnetic tape, and a galvanometer on a servo-positioned carriage prints the results on a photographic drum. The computer applies elevation, weathered zone, and normal step-out corrections and presents a seismic time cross-section, each trace being corrected to datum. A " flow diagram " of the equipment is given. C. A. F.

15. The Gulf seismic profile system. Anon. *World Petrol.*, 1957, **28** (3), 84.—The method of seismic data processing used by the Gulf Co is briefly described. The seismic profile which is developed by the system shows the complete seismic data recorded along a continuous traverse. Data are reproduced on closely spaced parallel tracks using variations in photographic density. These traces are corrected for datum, and corrections for elevation, weathering, and step-out have been applied. The result is a profile simulating a geological cross-section, enabling the seismic picture of the complete profile to be seen as a whole. C. A. F.

16. Activity of the seismic branch of the petroleum industry. J. Zytka. *Nafta (Krakow)*, 1936, **12**, 331–6.—For the first time in Polish petroleum industry has seismic work been introduced on such a scale. It is intended that all preparatory work for the 5 years' drilling will be done that way. Work on varying scale will be done, depending on local needs, and more or less detailed maps will be produced to lead drilling which will finally establish Polish geological structure. For the first year semi-detailed work is to cover Carpathian foothills, Lodz–Szczecin syncline, Sub-Sudetten monocline, Kujawy–Maritime anticline, and the edge and the mass of the E. European flats. The work was to be carried out by recent graduates, who for lack of experience have been lagging behind. In Dec. 1955 20 outfits were in the field. It has become necessary to adapt work and plans to the results which are obtained as the work is done. Detailed work is being done on Niwisk and Lubaczow anhydrite, which is known to contain gas. Districts Mogilno and Goplo, including the lake, are subjects of detailed investigation, thanks to gravimetric anomaly discovered there. The position near Turek is similar. Work in Wschowa–Ostrzeszow area shows little promise, but it ties up with the projected investigations of the Sudetten foothills. Investigations around Poznan are not promising, but the whole area N. of it is being investigated showing a positive anomaly extension. Territory N. of Warsaw is not included in the survey because of difficulties. M. S.

DRILLING

17. Seven steps to faster drilling. R. W. True and G. Bowman. *Oil Gas J.*, 1.7.57, **55** (26), 129.—Analyses of the drilling history and equipment used in drilling 4 wells in N. Louisiana are presented. They show how drilling time was reduced by 18 days and bit life increased by proper use of the equipment based on previous drilling experience in the area. 7 rules for improving drilling rates are given. 7 refs. C. A. F.

18. Where the turbo-drill scores. Anon. *Petrol. Press Serv.*, 1957, **24**, 286–9.—The modern rock bit can utilize far more power than the rotating drill string can transmit to it. A 12-inch bit might attain its max pen rate and max footage drilled per bit if it were operated at 700–800 rev/min with a wt of 80,000 or 90,000 lb on the bit. No rotary bit is capable of transmitting the requisite power, *ca* 400 h.p., to the bit. This greater power can be transmitted by turbo-drilling. This means—under suitable conditions—increased pen rate, therefore a bigger footage drilled per rig. If, for any reason, insufficient power be transmitted to the bit, turbo-drilling becomes more expensive. The turbo-drill is a commercial proposition when the val of time saved exceeds the increased costs involved. The relative advantage of the new technique increases as drilling conditions become more severe, *e.g.* in consequence of harder formations and greater depths, or need to drill deviated wells. R. T.

19. Progress report: how are turbo-drills performing? J. A. Mitchell. *Oil Gas J.*, 8.7.57, **55** (27), 106.—The results of field testing of Dresser turbo-drills are presented. Various sizes and types of these drills have been tested, and the main conclusions are that penetration rates are higher than those of comparable rotary drilling, bit footages are lower, and under certain conditions drilling costs are less. Recent developments in turbo-drilling are briefly described, and 3 case histories are outlined. 2 refs. C. A. F.

20. Economics of a change from rotary to turbo-drilling. Z. Onyszewski. *Nafta (Krakow)*, 1956, **12**, 321–3.—The turbo-drill, which went into operation in France in Jan. 1956, was made in Grenoble, but is stated to have been designed after the Soviet paper delivered at the Rome Congress, thus making France the third country to use the turbo-drill (after the U.S.S.R. and Rumania). This article gives details of the costing and efficiency in terms of formulæ and graphs. Whilst initial expenses may be higher due to the extra mud pumps required and the transportation and building costs involved, in view of the lower weight of equipment and smaller pipe requirements the savings should become effective very soon. Since, furthermore, wear of drill and other equipment is lower for turbo-drilling, the overall picture is very favourably disposed towards it. M. S.

21. Results of operation of rock bits. J. Tyczynski and H. Slupczynski. *Nafta (Krakow)*, 1956, **12**, 294–6.—Results of operation of rock bits are disappointing, due to excessive softness of the steel. The authors believe bits ought to be

nitrated. Due to use of incorrect lubricant, which is washed out by drilling mud, rollers are often wrongly aligned. Worn teeth are often repaired in the oilfield workshop, and they frequently break where the built-up portion has been added. Analysing other signs of wear, the authors conclude that whilst the steels used are on the whole quite appropriate, the lubrication of the rollers, the surface hardness of the teeth, and the repair work leave a lot to be desired. M. S.

22. Application of water instead of drilling mud. W. Paraszczak. *Nafta (Krakow)*, 1956, **12**, 264–7.—A review of the drilling processes using water as drilling fluid is made on the strength of 6 articles in *Nyeft. Khoz.* published between Feb. 1954 and Oct. 1955. Drilling described was done by the turbine method, and for reasons of large consumption, slow separation of contaminated fluid, and the rather high pressures involved in this method, water was found superior to conventional mud. Once the change-over was done, drilling speed went up. All the work was done in the Second Baku (Tuymazia and Tartary) regions, where geologically the field was well known. " Cloudy " waters were treated chemically, but eventually light muds were introduced based on water, with high lime contents and slight addition of slime. Work described covers years 1951–53. Now pure water drilling has been abandoned in the U.S.S.R. M. S.

23. Work of the Polish IP is utilized by petroleum drilling. W. Szwed. *Bull. Polish Inst. Petrol.*, 1956, **6**, 12 (Suppl. *Nafta (Krakow)*, 1956, **12**).—The first job done by the Polish IP was to produce a surface active agent from petroleum. Soon " mersol " detergents were produced from hydrocarbons, chlorine, and SO_2. This served as the starting point for production of $R–SO_2–NH–CH_2–COOH$ (alkylsulphamide acetic acid). Where R contains 20–30 C atoms, its Na salt is useful as corrosion preventive, cutting oils, emulsifier, etc., whilst the Na salt of the $C_{13–15}$ acid is oil soluble and so acts as a good dust-laying agent. Their effects on humans are being investigated. M. S.

PRODUCTION

24. Dual-string plunger lift is paying off. L. J. Tomlinson. *Oil Gas J.*, 8.7.57, **55** (27), 114.—Experience in using parallel tubing strings in plunger-lift pumps in the San Miguelito and Seal Beach fields, California, has shown that the method can be used to produce relatively deep wells to their final economic limit. In these areas the wells are pumping from below 6000 ft in most cases with rates down to 8 b.d.

2 basic types are used: where fluid levels are high 2½-inch and 1¼-inch tubing are run inside 7-inch or larger casings. In low level wells a 2-stage hook-up is used in which the 2½-inch production string is swaged down to 2 inches, and below this there is a 2-inch standing valve. In order that both strings can be run inside 5-inch liners the tubing is reduced further to 1½ inches.

In these wells fluid is intermittently gas lifted from near bottom into the 2½-inch tubing, and is then raised to the surface by plunger lift.

Details of the operation of the equipment are given and diagrams show tubing arrangements. C. A. F.

25. Tensile and compressive strength of formations. B. C. Craft. *Oil Gas J.*, 1.7.57, **55** (26), 138.—A knowledge of the tensile and compressive strengths of beds is useful in drilling, cementing, and fracturing operations. Cores of some W. Texas pays have been tested for these properties, and the results are presented in a table which lists formation, depth, average, max and min tensile strengths, and compressive strengths. The San Andres and Clear Fork limestones gave the highest tensile strengths, exceeding 1400 p.s.i. C. A. F.

26. Factors affecting well productivity. II. Drilling fluid particle invasion into porous media. E. E. Glenn and M. L. Slusser. *J. Petrol. Tech.*, 1957, **9** (5), AIMME Tech. Paper No. 4585, 132–9.—The transit of cloudy filtrate through porous disks shows that particles enter and even pass through. Subsequent collection of clear filtrate shows complete hold-up of clay particles.

In experiments in which graded particles were added to the mud it was found that the surge loss was reduced, and that the permeability measured after back-flushing was higher than for samples plugged by the base mud alone. Bridging by suitable particles may reduce internal filter cake formation. A model drill was used to study the effects of static plastering, drilling, and scraping. Subsequent slicing and study of the sample below the bit showed that mud invasion was usually most severe in the first 2–3 cm, the effective permeability of the sample to oil was greatly reduced (even after extensive back-flushing), and the entire sample (*ca* 5 cm) had a permeability to oil only 2–30% of the original value. Colorimetric tests using benzidine to detect bentonite showed that mud invaded the porous alundum samples and was partly retained. Capillary pressure measurements showed higher water saturation at a given capillary pressure for the clay-invaded samples. The effective filter cake permeability in the pores was estimated to be 50–300 times higher than for bulk filter cake. G. D. H.

27. Chromatographic analyser. Perforator without shell. J. J. Głogoczowski and R. Wolwowicz. *Bull. Polish Inst. Petrol.*, 1956, **6**, 9 (Suppl. *Nafta (Krakow)*, 1956, **12**).—2 separate short notices describing: (1) the " IN3 " analyser; and (2) a casing-less perforator based on Polish, American, and Hungarian designs wherein a jet of gas formed through the explosion of charge is directed by means of a copper cone and moving at 8000 m/sec perforates drill pipe. M. S.

28. Fluids for hydraulic fracturing of formations. B. Fleszar. *Nafta (Krakow)*, 1956, **12**, 323–5.—A review of British and American literature proving that the American fluids are better and indicating what line of research should be taken by the Polish IP. Soviet and Rumanian methods are mentioned. M. S.

29. U.S. oil: the next ten years. Anon. *Petrol. Press Serv.*, 1957, **24**, 289–92.—Government policy to restrict U.S. imports brings especial interest to a new analysis of longer-term demand and supply prospects published by Chase Manhattan Bank. Virtual inevitability of a >threefold increase in net imports to *ca* 3·3 million b.d. is forecast. Demand and production forecasts for the U.S.A. and the rest of the free world imply faster growth rates than those estimated earlier in respect of 1955 (*Petrol. Press Serv.*, March 1956, p. 87). U.S. demand will increase at an average rate of 5% p.a., or ⅔ total, to 14·3 million b.d. in 1966. The predicted average rise for the rest of the free world is 7·7%, or more than double by 1966, attaining a calc total of 14·2 million b.d. Revised estimates give a demand jump of 13 million b.d. (not 10·5) for the whole free world. To meet these enhanced requirements production in the U.S.A. is expected to increase by ⅔ to 11 million b.d. crude oil and natural gas liq, and elsewhere to increase twofold to 17 million b.d. A basic assumption gives average annual population increase in the U.S.A. as 1·6%, from 168 million last year to 197 million in 1966. From combined effects anticipated increase in energy demand is 3·8% p.a. Oil and natural gas production and contribution to total anticipated energy consumption are expected to rise sharply. To increase production in pace with consumption would incur disadvantages from the defence standpoint. Possible increase of 11 million b.d. leaves a gap of 3·3 million b.d. to be filled by imports. To find the required new reserves drilling will have to be increased to 72,000 wells p.a. by 1961

and 87,000 wells by 1966. Well-head prices of oil and natural gas will have to rise by 25% by 1966. R. T.

30. Current developments in the oilfields of the Middle East. D. A. Greig. *Canad. Min. metall. Bull.*, 1957, **50** (543), 417–21.—In 1926 3 oilfields produced 100,000 b.d. of oil. At the end of 1956 production was *ca* 4 million b.d. or 23% of total Free World production. Over 70% of Free World's proven reserves exist in Middle East subsoil. Production development is urgently necessary to meet projected energy requirements. Oil withdrawal rates are relatively low, 1·25% p.a.—due to the low energy available from the relatively small area of oil–water interface in proportion to the huge oil vol to be moved. In Egypt exploration continues in the W. Desert, but output is low. A new government-controlled company has taken over control of foreign interests. Syria's recent discovery at Karachok produced 1500 b.d. of 20° API oil from Upper Cretaceous; this rate dropped rapidly to *ca* 500 b.d. to the pump. Iraq is the centre of a flourishing oil industry with a current production rate *ca* 765,000 b.d. The government assigns 70% of the revenue to a Development Board for application to national development. Noteworthy in Iran (Persia) are oil industry development under the Consortium and recent discovery of a large producing well, Alborz No. 5. Kuwait is probably the richest known oil patch in the world. An off-take of *ca* 2 million b.d. can be visualized in the future. In Saudi Arabia—a wisely governed state—commercial production has been found in 5 reservoirs in the Jurassic, and one in the Cretaceous. Other fields of minor importance are discussed briefly. The transportation problem is also considered briefly. R. T.

OILFIELD DEVELOPMENT

31. Who'll drill the first 5-miler? F. J. Gardner. *Oil Gas J.*, 8.7.57, **55** (27), 185.—The world's deepest well is in Plaquemines parish, Louisiana, which was drilled to 22,570 ft in 1956, and oil was found below 20,000 ft. 2 further very deep wildcats are planned: (1) a 22,500-ft Ordovician test of the Fort Cobb anticline in Caddo County, Oklahoma, and (2) a 22,000-ft test, 15 miles SE. of Fort Stockton in Pecos County, Texas. Several deep wells are being drilled in Pecos County in the Sheffield channel. C. A. F.

32. Egypt hikes output. Anon. *Oil Gas J.*, 24.6.57, **55** (25), 119.—Output has increased from the Belayim field on the Sinai peninsula, reaching 11,900 b.d. in April 1957. 600 b.d. was being produced from the Feiran field near by, and total Egyptian production for April was 46,000 b.d., the highest for *ca* 4 years.

There are *ca* 12 completed wells at Belayim, which is under development, and a second well is being drilled in the new field at Rudeis. C. A. F.

33. India field looks up. Anon. *Oil Gas J.*, 1.7.57, **55** (26), 104.—25 wells have been drilled in the Nahorkatiya field in Assam. 18 of these are producers and 2 are gas wells, and further wells are being drilled. It is estimated that the field has a potential of 50,000 b.d. and 45,000 M.c.f/day of gas for a period of 20 years, or proved reserves of over 365 million brl. To handle this output a refinery is planned at Barauni, 250 miles NW. of Calcutta, and a pipeline from the field to the refinery is being considered. C. A. F.

34. Stanvac needs reserves. Anon. *Oil Gas J.*, 8.7.57, **55** (27), 87.—Main Stanvac production in Indonesia comes from Central Sumatra, where production averages 60,000 b.d. The fields in S. Sumatra are producing only *ca* 2000 b.d., and further concessions are needed in the country to improve the ratio of reserves to production.

The Lirik field in Central Sumatra will produce shortly, with an estimated production of 30,000 b.d. between 1959 and 1961. C. A. F.

35. Borneo tested offshore. Anon. *Oil Gas J.*, 24.6.57, **55** (25), 119.—*Ca* 12 wells are to be drilled from an offshore platform in the Seria field in British Borneo as part of a plan for further development of the declining field, which has produced over 370 million brl since its discovery in 1929. Current production is *ca* 114,000 b.d.

Offshore wells are also to be drilled at Siwa, near the Miri field in Sarawak, and at Hankin Shoal, *ca* 30 miles N. of Labuan in N. Borneo. There have been no new discoveries in Borneo since the last war, except for one producing well at Jerudong. C. A. F.

36. On the proper development of petroleum industry in Poland. S. Wazis. *Nafta (Krakow)*, 1956, **12**, 319–21.—The old 6-year plan and the current 5-year plan are largely unfulfilled in the basic respect of providing more crude for the expanding needs of the Polish petroleum industry by means of drilling. To illustrate the point the author states that in 1954 indigenous production covered 24% of nation's need, in 1955 11%, and in 1960 it will only supply 5% of it. Not only does the relative proportion fall, which is due to constant supply facing increased demand, but the actual production in 1960 is to fall by 5·5%. The figures for 1946–56 show a steady fall. In particular, it is noticeable in drilling, where for the years 1949–54 only 59·5% of depth planned was drilled. The presence of gas and crude in the Polish territories has been proved by recent small discoveries, and plans should therefore be revised, starting with more equipment. M. S.

TRANSPORT AND STORAGE

37. Collapsible tanks for land and marine transport. Anon. *Fluid Handl.*, 1957, 261–2.—Illustrated description is given of 850-gal collapsible tanks for transport of mineral and edible oils, chemicals, etc. One type is fixed to a lorry; the other can be transferred to or from a ship. The tare wt of both types is <1 ton and, when collapsed, they can carry top loading. Advantages of using a 850-gal tank instead of 22 40-gal drums are enumerated. W. A. M.

38. Are you getting full value from your air photos? J. G. Johnstone. *Oil Gas J.*, 16.9.57, **55** (37), 141.—Advice is given on how to use air photography, discussing what air photographs reveal, *e.g.* type of crossings and vegetation. A typical photograph is analysed. G. A. C.

39. Tankers: past, present, future. A. S. C. Hulton. *J. Inst. Transp.*, 1957, **27**, 157–62, 175.—After the middle of the nineteenth century oil took its place in international trade. The oil industry as we know it to-day dates from 1859, when Colonel Drake drilled his 69-ft well at Titusville, Pa. Production has risen from 20 to 800 million tons in *ca* 50 years. Transatlantic transport is traced from the *Elizabeth Watts*, 224 tons, with stowage in wooden brl. A specially designed iron sailing ship with large tanks to replace wooden brl appeared in 1863. *Ca* 1872 the *Vaderland* was built for passenger and oil transport, but failed to obtain official approval. The *Gluckauf*, built on the Tyne in 1885, with a gross tonnage of 2307 tons, was the true prototype of the modern tanker. The first fully laden tanker, the *Murexe*, of

5000 tons dwt, passed through the Suez Canal in 1892. In 1900 the dwt tonnage of the world's tanker fleet was half a million tons, in 1956 it is *ca* 45 million tons. During world war II America's efforts in tanker construction were phenomenal. During the war some tankers were converted to aircraft carriers. Factors affecting the economic position of refining alongside the crude oil production are transport of crude or finished products, the relative cost of shipment in large or small tankers, and limitations in tanker size, which must be tailored to the trades and the ports. Great strides have been made in reducing turn-round time in port. Attention is paid to corrosion prevention; cathodic protection with Mg anodes and Epikote resin paints have proved successful. Factors affecting transport through the Suez Canal are vitally important. R. T.

40. World tanker fleet review. J. I. Jacobs and Co. Ltd. *Petrol. Times*, 13.9.57, **61** (1568), 813.—A half-yearly analysis is given showing new building, ownership, position in shipyards, size and physical features, and future outlook. A table shows ownership of world tanker fleet of 2000 dw tons and over at 30 June 1957. G. A. C.

41. Predict 2 billion expansion for Canadian gas line. Anon. *Pipe Line News*, 1957, **29** (8), 19.—It is predicted that $2 billion will be spent during the next 5 years on natural gas pipeline expansion in Canada. A breakdown of this figure is given. D. B. S.

42. Trans-Canada rushes 34-inch line. W. R. Quarles. *Pipe Line News*, 1957, **29** (8), 27–33.—The 230 miles already laid and the 439 miles due for completion in 1957 of Trans-Canada's 2200-mile system are described. D. B. S.

43. Pumping heavy Sumatra crude presents many problems. J. M. Rupert. *Pipe Line News*, 1957, **29** (8), 56–61.—Difficulties encountered in designing a crude line to carry oil having a pour point as high as 110° F are discussed. Line dia is 8 inches, and 5 pumping stations are used, 30 km apart. Throughput is 32,000 b.d., and provision is made for heating the crude above its pour point by means of a 3-inch dia hot water line laid under the 8-inch line, and operated at 1000 p.s.i.g. and 180° F. D. B. S.

44. A pipeline for Sumatra crude oil. J. M. Rupert and B. N. van Diemen de Jel. *Petrol. Times*, 27.9.57, **61** (1569), 859.—The problem involved in transporting the high pour point Sumatra crude by 8-inch pipeline from Lirik field to the deep water terminal, on the Liak River some 100 miles away, is discussed.

An experimental 6-inch line was constructed and tests made with congealed crude; as a result a system with smallest possible pipe dia was designed. Thus pumping rates, heating, and station spacing would be well within zone of safety. Heat is provided by 4 60-h.p. Jonkers oilfield boilers, and each station has 4 Triplex Aldrich pumps provided by D.375 Caterpillar diesels. G. A. C.

45. Piping design for branch connexions. J. Y. Briggs. *Oil Gas J.*, 16.9.57, **55** (37), 178.—This special design problem is discussed, and it is shown how to restrain or absorb pipe expansion and how to make branch connexions. G. A. C.

46. Loopholes in the pipeline code. R. G. Strong and A. G. Barlow. *Oil Gas J.*, 16.9.57, **55** (37), 162.—Pipe now on offer does not completely meet specifications, and means to remedy this are discussed, and include control of chemical and physical properties and of manufacturing tolerances. The user should recognize properties of the materials and adjust his construction procedure and control accordingly. G. A. C.

47. Pipeline-flow efficiency testing. R. F. Bukacek and R. T. Ellington. *Oil Gas J.*, 16.9.57, **55** (37), 211.—In this first of 3 articles recommendations are made for the equipment and measuring techniques and procedures to be used for determination of pipeline-flow efficiency. G. A. C.

48. Soil mechanics important in marine pipeline construction. R. J. Brown. *Oil Gas J.*, 16.9.57, **55** (37), 151.—2 possible preventive methods for dealing with excessive vertical displacement involving newly completed lines are discussed. One measure involves filling pipe with water during construction, burying and allowing time for rehealing of soil before removing water, and second uses heavier pipe and backfill. G. A. C.

49. Development of the Starachocina–Gliniczek–Pilzno gas pipeline. W. Kolodziej. *Nafta (Krakow)*, 1956, **12**, 325–7.—Since the discovery of a new field at Starachocina and increased demand for gas, which occurred simultaneously, there was need for an increase of throughput through the existing pipeline, whilst the short prospective productive life of the new field made it important not to spend too much on it. There are 2 existing pipelines between Starachocina and Krosno, one through Besko (partly 180 mm dia, 35 atm working pressure, and partly 250 mm dia, 25 atm working pressure) and one through Haczow (250 mm dia, 25 atm working pressure). Krosno–Gliniczek line is 250 mm dia and 25 atm working pressure recently made capable of withstanding 30 atm. From Gliniczek 2 mains take gas W. (to Cieszyn, Rybnik, and Gliwice in Silesia) and N. to Kielce, Skarzysko, and Warsaw. The changes decided upon are to build a new line from Krosno to Warzyce (300 mm dia, 40 atm) and to join it to the 2 mains simultaneously with adaptation of the 2 short supply lines: Starachocina–Haczow–Krosno to 40 atm and Gliniczek–Pilzno to 35 atm and transfer of some of the distributive work from the Gliniczek to the Warzyce distributing station. Constructional details are given. M. S.

50. Hydraulics for pipeliners. Pt XXIV. Pump station controls. C. B. Lester. *Pipe Line News*, 1957, **29** (7), 25–9.—Controls may be divided into 3 groups—load controls, station function controls, and unit function controls. Load controls ensure that the station is pumping in step with other stations in the line and the controller is used to reduce the pump speed if, say, the suction pressure drops and the discharge pressure increases. A proportional plus reset controller is suggested. Station function controls are shut-down controls that operate when conditions outside the normal range occur. Unit function controls are particular safety controls which depend on suction pressure, pump temp, seal leakage, etc. D. B. S.

51. Getting a pipeline across a river. L. M. Odom. *Oil Gas J.*, 15.7.57, **55** (28), 96.—Pt 2 of the contribution deals with the factors involved in design of a pipeline river crossing, effects of buoyance, stream currents and turbulence, sand movement, corrosion, etc. G. A. C.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

52. How to evaluate a plant layout. F. D. Macy. *Petrol. Refin.*, 1957, **36** (7), 162–8.—A cross-reference or travel charting technique has been developed as a supplementary aid to the flow diagram and the use of models in evaluating a plant layout. This technique establishes the inter-relationship among the various production or storage areas and points out possible areas of improvement with reference to optimum travel distance. It also gives a basis of understanding in that the layout can be expressed in numbers. The author outlines the application of the technique in evaluating the layout pattern of Shell Oil Co's wax moulding and shipping building in their Houston refinery. Use of the technique applied to an experimental case of an operating unit layout is also considered, the present layout being compared with a revised layout that could have been used. The main advantages of the travel chart are listed. J. R. T.

53. Capitalized costs ease choice of materials. R. B. Norden. *Chem. Engng*, 1957, **64**, 292–4.—The use of capitalized costs as a tool for making economic decisions is illustrated by the choice of material for heat exchanger tubes in a large power plant condenser. P. J. O.

54. Charts aid bubble cap tray design. R. Nokay. *Chem. Engng*, 1957, **64**, 284–6.—The two charts given determine: (1) uncorrected liq gradient, and (2) head over the weir and head loss under the downcomer. 6 refs. P. J. O.

55. Turbine or motor drives? H. C. Mayo and R. E. Daze. *Petrol. Refin.*, 1957, **36** (8), 110–15.—As new refinery process units become larger in size their steam and power requirements are greatly increased. Several of these units, such as cat cracking and reforming, may require up to 30,000 h.p. This article discusses selection of larger h.p., high-speed rotating prime movers for refinery and petroleum chemical applications in the 2000–15,000-h.p. range as used for driving centrifugal and axial compressors. The presentation covers the steam turbine, electric motor, and combustion gas turbine, as well as the newer free-piston gasifier with expansion turbine. An economic comparison of these 4 methods is presented and indicates that energy is the predominant operating cost. J. R. T.

56. How turbines can work in your process. W. B. Wilson *et al.* *Petrol. Refin.*, 1957, **36** (8), 116–22.—The wider variety of gas turbines being offered at the present time, coupled with the fact that modern process plants are much larger and operate at higher pressures, ensures future widespread use of this versatile prime mover. A list of services that the gas turbine has to offer includes shaft power, compressed air, process steam, hot gases for direct drying of products, highly preheated air for process use, and efficient use of process high energy waste gas. Several applications of gas turbines in refinery and petroleum chemical processes are described with the aid of flow diagrams. These include the Thermofor cat cracking process, Hydroforming regenerator, cat regeneration in the dehydrogenation process for production of butadiene, a synthetic ammonia process, production of ethylene, and manufacture of ethylene oxide. J. R. T.

57. New ideas on steam turbine economy. W. B. Wilson *et al.* *Petrol. Refin.*, 1957, **36** (8), 122–6.—Savings in the cost of electrical power are important in the petroleum and allied industries in view of the fact that its use has increased by approx 80% in the last 10 years and is increasing still further. Overall refinery operating costs can be reduced by the installation of turbine generators to supply steam and power. The authors outline a method of reducing overall operating costs by the use of higher initial steam conditions, more feed water heating, and the use of mechanical drive turbines. Several additional characteristics of the steam turbine that can be utilized to advantage in a refinery are outlined and illustrate that the steam turbine cannot be overlooked in expanding existing refineries or planning new ones. J. R. T.

58. Does your condensate need de-oiling? L. Walter. *Petrol. Refin.*, 1957, **36** (7), 194–5.—A description is given of a simple oil separator that will recover oil from a condensate, and thus allow its further use, for example in heating boiler feed water. A filtration method for extraction of traces of oil is also described, and minimum dimensions, depending upon the vol of condensate handled, are tabulated. A third design for vertical flow under pressure is also illustrated. J. R. T.

59. Thermal diffusion gets attention. A. L. Jones. *Petrol. Refin.*, 1957, **36** (7), 153–7.—Recent studies of thermal diffusion have shown it to be applicable to hydrocarbon separations in all mol. wt. ranges through asphalt, and particularly so for the separation of the higher boiling constituents of petroleum. A short review of several different types of thermal diffusion apparatus is presented in this article. A new system of operation for batch-type columns has been devised, by the author, which greatly simplifies multi-stage operations and eliminates many undesirable aspects of single column performance. The method involves an interconnected multi-tube assembly of batch-type columns fed and sampled on an intermittent basis. The minimum number of columns for this type of assembly is 2, but the sampling rate is directly proportional to the number of columns. A description of the operation of a 4-column assembly is given with reference to the degree of separation obtained. J. R. T.

60. Reactors can "float" . . . on ball bearings. E. P. Owen. *Petrol. Refin.*, 1957, **36** (6), 129–32.—Socony Mobil Oil's new cat reforming unit at Paulsboro, N.J., incorporates several interesting structural features. One of the unique features of the project is the fact that the reactors and charge exchangers are mounted on ball bearings and thereby float freely within the recycle piping system. The article outlines the main advantages and disadvantages of the method, with particular reference to the piping stress. The ball bearing assembly is described in some detail. J. R. T.

61. Eliminate steam tracer lines. H. S. Bell. *Petrol. Refin.*, 1957, **36** (6), 175–8.—A new method of applying electrical energy for maintaining a constant temp in hot oil transmission lines has been developed and used successfully in recent years by utilities and process industries. This article discusses both conventional and electrical methods with reference to operational costs, maintenance, safety factors, and capital cost. The electrical method appears to have very few limitations with respect to distance, temp, size of line, or vol of flow. J. R. T.

62. Centrifugal pump packings and seals. Pt 4. Mechanical seal maintenance. H. Woodhouse. *Petrol. Refin.*, 1957, **36** (5), 243–6.—This article outlines the causes of mechanical seal troubles and gives methods of locating these troubles. A series of general instructions for the installation of such seals is included, together with methods of seal maintenance. J. R. T.

63. Flow control by fluid couplings. D. S. Townend. *Petrol. Times*, 13.9.57, **61** (1568), 804.—A study is given by the British Petroleum Co. Ltd of infinitely variable speed reducing equipment at present on the market and with particular reference to the fluid coupling manufactured by Fluidrive Engineering Co.

Diagrams show flow control by coupling, pressure control and power characteristics, and 2 types of fluid coupling units. G. A. C.

64. New digital computer is especially designed for process control. D. H. Stormont. *Oil Gas J.*, 2.9.57, **55** (35), 151.—Features are given of the Ramo-Woolridge computer systems, costing $100,000 to $150,000, for use as central units of process control systems. The computer can also be used to detect trouble in a process and in the control system. G. A. C.

65. Petrobras expanding mataripe refinery. J. C. Reidel. *Oil Gas J.*, 16.9.57, **55** (37), 226.—The Brazilian-controlled oil company is adding crude-dist units, atmospheric and vacuum dist units, and cat lub oil and wax-processing facilities to its refinery near Salvador (Bahia), throughput being stepped up to 37,000 b.d. Crude is waxy domestic Dom Joao oil, unusually suitable for lub oil and wax production. A Podbielniak centrifugal extractor will be used in lub oil processing instead of a conventional solvent extraction tower. Flow sheets show light oils processing, propane deasphalting, and phenol extraction. G. A. C.

66. From experience of complete mechanization of refitting work at a refinery. A. Ablamowicz. *Nafta (Krakow)*, 1956, **12**, 330–1.—By application of a "transporter," lorries, and grabs which can act as cranes the refitting of the refinery at Krasnikamsk has been accomplished with about $\frac{1}{3}$ of the labour force usually required. M. S.

67. Lowering operating temperature of an activated-carbon stripping unit; nuclear-purity coke; chromatographic estimation of aromatics. Z. Pomykala, L. Gorski, and W. Bogdanska. *Bull. Polish Inst. Petrol.*, 1956, **6**, 10 (Suppl. *Nafta (Krakow)*, 1956, **12**).—3 separate short papers dealing with: (1) twofold increase of the efficiency of absorbers by lowering their operating temp from 35° to 0° C by means of expanding propane; (2) double-distilled naphthalene serves as a source of pure carbon which can be used for the manufacture of graphite suitable for use in nuclear reactors; (3) the method is more accurate than aniline point. It is based on retention of aromatics by the adsorbent and subsequent concn evaluation by refractivity method. M. S.

DISTILLATION

68. How to figure minimum reflux. J. B. Bachelor. *Petrol. Refin.*, 1957, **36** (6), 161–70.—A practical method is described for the accurate calculation of minimum reflux in multicomponent dist systems. The method is not based on the usual limiting assumptions of constant relative volatility and constant molal overflow, but employs a relaxation technique. It does not attempt the solution in a single complex-step, but applies simple successive steps that converge, with any degree of accuracy required, to the true minimum reflux. Development of the method is complex, but its application is a simple numerical procedure with a minimum dependence on the experience of the operator. The method is illustrated by 2 example solutions for a part vapour feed and a sub-cooled liq or superheated vapour feed respectively. J. R. T.

ABSORPTION AND ADSORPTION

69. Examine these ways to use selective adsorption. Molecular Sieve Dept, Linde Co., New York. *Petrol. Refin.*, 1957, **36** (7), 136–40.—The use of molecular sieve adsorbents, such as synthetic crystalline zeolites, allows economical operation of fixed-bed adsorption for single step purification or for final clean-up through process staging in conjunction with other purification methods. These zeolites are capable of making sharp separations of liq or gas stream components, usually without regard to comparative b.p. A brief description is given of the way in which these separations are made. Data are presented for several applications of the process which are either in production operation or in advanced pilot-plant stage. These include the extraction of CO_2 from ethylene, removal of acetylene and acetone from ethylene, the drying of liq, and the selective removal of sulphur cpds. The possibility of using the molecular sieve as a means of upgrading gasoline stocks by selective adsorption of *n*-paraffins is mentioned. J. R. T.

70. How to test absorbers. W. R. Marshall *et al.* *Petrol. Refin.*, 1957, **36** (6), 187–92.—To conduct performance tests on absorbers A.I.Ch.E. has proposed a new standard testing procedure which provides a standard means of comparing manufacturers' predicted performance. Pts 5 and 7 of this procedure, namely, test procedure and interpretation of results, are reproduced in full in this article. A complete text of the other parts is also included. J. R. T.

71. New gasoline plant processes gas from 14 Texas pools. R. J. Brosamer and C. G. Eaheart. *Oil Gas J.*, 9.9.57, **55** (36), 100.—Units for natural gasoline plant of Phillips Petroleum Co at Andrews, Texas, are described, including booster stations, gas heaters, reabsorbers, measurement, and instrumentation. A flow sheet is given. G. A. C.

SOLVENT EXTRACTION AND DEWAXING

72. Here's data on propane fractionation. E. E. Smith and C. E. Fleming. *Petrol. Refin.*, 1957, **36** (7), 141–4.—The application of propane fractionation to the separation of hydrocarbons according to their solubility in the liq solvent is considered. A description of a continuous liq–liq extraction pilot plant to investigate propane fractionation of long residua is given. Data are presented to illustrate the effect of temp and propane–oil ratios on the final oil obtained. A comparison of oil fractions prepared by both propane fractionation and routine dist showed a small but definite difference in composition of the product, this difference indicating that the former process separates hydrocarbons, according to mol. wt. rather than structure, to essentially the same degree as dist. The main advantage of propane fractionation is, however, that a greater yield of a more stable oil is obtained under conditions which eliminate thermal decomposition. J. R. T.

73. Extractive crystallization to-day. L. C. Fetterly. *Petrol. Refin.*, 1957, **36** (7), 145–52.—This article reviews the extractive crystallization process with special reference to the method of urea adduction. A brief review of the properties of these urea complexes is given, and several of the problems inherent in their use outlined. Several commercial urea extractive crystallization units are described, and data are presented for the dewaxing of spindle oil and mineral white oil by 2 of these processes. The main operating characteristics of these units are summarized in tabular form, and a comparison of urea and solvent dewaxing is presented. Several applications of the extractive crystallization technique in other fields are also outlined. J. R. T.

CRACKING

74. When to discard reformer catalyst. R. B. Smith and T. Dresser. *Petrol. Refin.*, 1957, **36** (7), 199–202.—Data are presented in graphical form which enable the calculation of

the optimum point of discard of a cat in the case of fixed bed cat reformers. 2 worked examples are included to illustrate the application of these data to the calculation of the ultimate life of a cat. The results of these examples show that when cat life is shorter due to more severe operating conditions, the optimum terminal activity is lower. The reason is that more yield decline can be tolerated when the cat cost is higher.
J. R. T.

75. "Package" concept cuts expansion cost. T. B. Arnold and S. Valentine. *Oil Gas J.*, 9.9.57, **55** (36), 97.—Vickers Petroleum Co has increased the capacity of its package T.C.C. plant by 50% in Potwin, Kansas, by adding a third kiln to the cat cracker and revising the cat and oil circulation systems where necessary drawings show modifications.
G. A. C.

76. Fluid catalyst design data. Pt 2. Find best particle size distribution. F. A. Zenz. *Petrol. Refin.*, 1957, **36** (5), 261–5.—Particle size distribution as it affects desirable fluidization characteristics is still a qualitative field. In this article the published data are drawn together into a logical pattern that permits a certain degree of quantitative treatment. Optimum particle size distribution is found to approach the skew probability form, resulting in an approx eleven-fold variation in particle size.
J. R. T.

HYDROGENATION

77. Set conditions for hydrogen treating. E. J. Hoffmann, E. W. Lewis, and E. F. Wadley. *Petrol. Refin.*, 1957, **36** (6), 179–86.—The hydrogenation process is receiving attention as a means of improving the stability and gum forming tendencies of cracked motor gasoline blended stocks. The postulation that conjugated diolefins promoted gasoline instability and certain engine deposits led the authors to attempt the development of a process which would remove diolefins at conditions such that mono-olefin conversation was a minimum. Pilot plant data were obtained by Hydrofining a thermally cracked naphtha using a nickel tungsten sulphide cat. The authors summarize the process development work and certain kinetic interpretations of the data which led to the discovery of a commercial process possessing the necessary operating characteristics.
J. R. T.

ALKYLATION

78. First post-war butadiene plant. W. J. Brack and M. R. Beychok. *Petrol. Refin.*, 1957, **36** (6), 143–7.—A description is given of the Texas Butadiene and Chemical Corpn's new butadiene plant, which was designed to produce 64,800 tons/year of butadiene from *n*-butane and *iso*butane feed. The plant is basically divided into 3 main areas, namely, the dehydrogenation area, the recovery area, and the sulphuric acid alkylation area, and these main features are described in detail. A description of the hydraulic system employed for operation of the reactor valves in the dehydrogenation unit is given. Plant utilities and offsite facilities are also outlined.
J. R. T.

ISOMERIZATION

79. Case for upgrading natural gasoline. R. E. Sutherland and D. H. Belden. *Petrol. Refin.*, 1957, **36** (7), 189–91.—Increasing the O.N. of natural gasoline results in a product having the necessary qualities to make a good premium blending component in motor fuels. Significant improvements in O.N. can be obtained by cat reforming and isomerization. This article presents an economic comparison of 2 processes, both having in common the platforming of the C_7 + virgin naphtha in the natural gasoline, but one using an additional Penex de*iso*pentanizing process. This latter process is illustrated diagrammatically. The results of the comparison are tabulated and show the relative cost of operation of the 2 processes together with the yearly profit and payout.
J. R. T.

80. Hydroisomerization by the Penex process. D. H. Belden, V. Haensel, W. G. Starnes, and R. C. Zabor. *Petrol. Times*, 27.9.57, **61** (1569), 853.—This is a reproduction in full of the paper on the Penex process presented at the 22nd Mid-Year Meeting of the API Refining Division, May 1957. Isomerization of C_5 and C_6 paraffins for production of gasoline blending components in the process is characterized by high conversion and high recovery of liq product at economic costs. Flow diagrams are given with tables showing yields and compositions.
G. A. C.

CHEMICAL AND PHYSICAL REFINING

81. Bauxite heaters save of D-X Sunray. V. L. Brant. *Oil Gas J.*, 9.9.57, **55** (36), 103.—The caustic-wash facilities have been replaced by the bauxite treating system at the Tulsa plant, and as a result maintenance and down-time costs have been reduced, as have neutralizing and inhibiting costs. Water content of recycle *iso*butane has also been reduced and saving made in TEL consumption by improving lead susceptibility of alkylate.
G. A. C.

SPECIAL PROCESSES

82. Recent advances in solvent dewaxing. P. W. Sherwood. *Sci. Lubric.*, 1957, **9** (1), 25–9.—A brief survey is presented of the historical development of solvent dewaxing of lub oils; basic principles are discussed in some detail, and factors in the selection of solvents are outlined. Dual solvent processes, propane dewaxing, Bari-Sol, and Separator-Nobel processes are briefly described.
J. G. H.

83. Survey of petrochemical plants. Anon. *Oil Gas J.*, 2.9.57, **55** (35), 124.—Existing plants and their products are shown in 6 tables—organic chemicals, ammonia and nitrogen products, butadiene and synthetic rubber, sulphur conversion plants, carbon black, and Canadian petroleum chemical plants.
G. A. C.

84. Petrochemical report. Anon. *Oil Gas J.*, 2.9.57, **55** (35), 107.—15 selected processes are described, including manufacture of ethylene, propylene, acetylene, butadiene, oxidn of propane and butane, Udex extraction, polymers of propylene, ammonia, sulphur recovery, and carbon black.
G. A. C.

PRODUCTS

CHEMISTRY AND PHYSICS

85. Properties of superheated 1-butene. D. S. Davis. *Chem. Engng*, 1957, **64**, 282.—A nomograph is given for the specific vol of butene at various temp and pressures. P. J. O.

86. Derivation and precision of a new vapour pressure correlation for petroleum hydrocarbons. J. B. Maxwell and L. S. Bonnell. *Industr. Engng Chem.*, 1957, **49**, 1187–96.—A new linear correlation is suggested which may be used for both pure hydrocarbons and narrow boiling mixtures. Charts and tables are given and the effect of chemical type (*i.e.* paraffins, aromatics, naphthenes, etc.) may be included by the use of a characterization factor. The charts range from pressures of 0·01 μ mercury to 100 atm and from 100° to 1500° F, and a statistical analysis has shown the standard error of the correlation to be only 0·8° F per tenfold change in vapour pressure. D. B. S.

87. Flame propagation rates. Chemical nature of attachment surfaces. L. Lapidus, J. B. Rosen, and R. H. Wilhelm. *Industr. Engng Chem.*, 1957, **49**, 1181–6.—The effects of the surface on the flame propagation rates of methane–air mixtures were investigated using a slot rate burner. The activities of dry surfaces were found to increase in the order magnesium oxide, brass, and platinum, but in moist conditions the rates were identical for the 3 surfaces. The effect of methane : air ratio was also investigated, and at high ratios the effects caused by the surface and its condition disappeared.

The data are explained by theoretical methods which relate the rate of free radical surface recombination to the flame propagation rate. D. B. S.

88. Supersaturation in hydrocarbon systems—*n*-pentane in the liquid phase. W. B. Nichols, L. T. Carmichael, and B. H. Sage. *Industr. Engng Chem.*, 1957, **49**, 1165–72.—The problem of the formation of bubbles in supersaturated hydrocarbons was investigated using *n*-pentane, at temp between 160° and 280° F, and the data analysed by regression methods. They indicate that under non-equilibrium conditions the bubble formation in a given vol of liq at constant strain is a random process. D. B. S.

ANALYSIS AND TESTING

89. Need help with gas chromatography? H. N. Morrow and K. B. Buckley. *Petrol. Refin.*, 1957, **36** (8), 157–61.—Gas chromatography has become an important analytical tool due to its speed, simplicity, reliability, and low operating cost. This article presents data for several types of hydrocarbon separations using different partition columns. All columns were made up with celite, 50–60 or 60–80 mesh, as a support for the partition liq and all packings used a ratio of 4 parts partition liq to 10 parts celite by wt. Data are presented for the separation of saturated hydrocarbons using both vacuum pump oil and benzyl benzoate as partition liq. Results for the separation of mixtures of unsaturated hydrocarbons on 4 different columns are presented. The partition liq used were dimethylformamide, a combination of diethyl formamide and silicone oil, and a combination of vacuum pump oil and hexamethylphosphoramide. The fourth column consisted of activated alumina modified with 2% silicone oil. Retention times are listed for the individual hydrocarbons on each of the columns mentioned. A method for the quantitative determination of hydrogen is also outlined. J. R. T.

90. New trends in analysis of gaseous hydrocarbons. J. J. Glogoczowski. *Nafta (Krakow)*, 1956, **12**, 268–72.—After the pre-war methods of Orsat and Podbielniak were found too rough and ready, an attempt to apply spectrography was made in 1950, but this gave way to chromatography, which is visibly less complicated. Methods and their variants are described giving numerical data for the most effective rates of flow, choice of diluents and eluents, and methods of detection used in Czechoslovakia and U.S.S.R. M. S.

91. Tapping test for evaluating cutting fluids. C. D. Flemming and L. H. Sudholz. *Lubric. Engng*, 1956, **12** (3), 199–203.—A method for the evaluation of cutting oils and soluble oil emulsions based on the torque measurements developed in the tapping process is reported. Test equipment, conditions, and procedures used are described and illustrated, and details of the standard reference fluids employed are presented. Correlation with field performance on corresponding methods is satisfactory; variations encountered with different metals may be considered a limitation. J. G. H.

92. Determination of " active " sulphur content of sulphur-bearing cutting fluids. Report of Subsection 1 of Section 1, Technical Committee K, ASTM Committee D-2 on Petroleum Products and Lubricants. O. L. Brandes. *Bull. Amer. Soc. Test. Mat.*, 1956, (214), 28–30.—Details are presented of the results of co-operative investigations of the determination of " active " sulphur in cutting fluids as laid down in Federal Spec. VV-O-283. These indicate that the " active " sulphur so determined is simply a measure of that portion of the sulphur content which will react with the metal or metal powder under the particular conditions employed, and that further information on the correlation of these results with fluid behaviour in reliable performance tests is necessary for serious evaluation of the method. J. G. H.

93. New atmospheric cycling test for corrosion study. T. J. Nussdorfer and D. O. White. *Bull. Amer. Soc. Test. Mat.*, 1956, (214), 61–5.—Work on the evaluation of volatile corrosion inhibitors used in the shipment and storage of aircraft engines revealed the inadequacy of existing test equipment for this purpose. Basic principles are set out of new equipment for evaluation which can be readily adapted for use with reciprocating or turbo-jet engines, and correlation of results so obtained with field results is indicated. J. G. H.

94. Spectrographic investigations of occurrence of rare metals in crude oil ashes. Z. Gregorowicz. *Nafta (Krakow)*, 1956, **12**, 273–6.—As a result of an investigation into the metallic content of the petroleum ash originating from 32 Polish and 5 foreign crudes by spectroscopic methods it has been established that the metals present were V, Ni, Co, Cu, Ti, Cr, Ag, Mo, Au, and Be, none of them in commercially useful quantities in Polish crudes. Low V content facilitates refining. M. S.

95. Measurements of the size of droplets from convergent and divergent nozzles used in oil burners for steel furnaces. E. J. Burton and J. R. Joyce. *J. Inst. Fuel*, July 1957, **30** (198), 395.—The method used to determine the size of droplets from nozzles in oil burners designed to give max forward thrust was to replace the fuel by wax blended to the same visc and to analyse the resulting wax droplets which freeze in flight. Fuel flows were from 70 to 300 lb/hr with atomizing air fuel ratios ranging from 0·7 to 1·7 lb/lb.

Results showed, except at lowest flow rate that the median size ranged from 47 to 70 μ, values comparable to those from steelworks burners.

Spray parameters for each flow rate are given.

Nozzle profile and distance of fuel pipe from nozzle had no appreciable effect on size distribution.

8 literature refs. 6½ pages of discussion. D. K.

ENGINE FUELS

96. Jet age to bring revolution in fuels. G. Weber and J. P. O'Donnell. *Oil Gas J.*, 9.9.57, **55** (36), 51.—Future demand and trends for jet engine fuels are reviewed. Until relationship of the jet plane, jet engine, and jet fuel are fully known rigid specifications for fuel cannot be established.

Tables show consumption capacity and fuel rates for various planes, and civil aircraft orders for the period 1957–63.

G. A. C.

GAS OIL AND FUEL OIL

97. Flow and disintegration of thin sheets of visco-elastic fuels. N. Dombrowski, P. Eisenklam, and R. P. Fraser. *J. Inst. Fuel*, July 1957, **30** (198), 399.—The disintegration of sheets of visco-elastic hydrocarbon gels was studied. The fuels investigated were 8 petroleum gels of consistency range 25–210 Gardner and velocities of liq in still air of 1200–3750 cm/sec and also for comparison several other gels from a low consistency up to 1650 Gardner. Sheets were produced by discharging gels from single-hole fan-spray nozzles. Results obtained are discussed. 3 pages of discussion, 9 literature refs, and numerous photographs are included. D. K.

LUBRICANTS

98. Lubricant specifications. 7(a). Temporary protectives and rust inhibitors. E. G. Ellis. *Sci. Lubric.*, 1957, **9** (1), 25–8.—The development, general composition, and applications of temporary protectives are outlined and the requirements of Min. of Supply Spec. C.S. 2296A for preservative mineral jelly, beeswax are discussed in detail. J. G. H.

99. Correct lubrication of textile machinery. 3. Spinning room lubrication. S. J. Chisholm. *Sci. Lubric.*, 1956, **8** (6), 22–4.—The importance of correct spindle lubrication is emphasized, and the requirements for lubricants for bath-lubricated spindles are set out. The use of textile spindle dynamometers in studying performance characteristics in spindle operation and so cutting out power losses is described, together with factors affecting the power requirements for driving spindles. J. G. H.

100. Pressure drop across metallic filters. Anon. *Sci. Lubric.*, 1956, **8** (12), 30–1.—Work reported previously is continued with "cup" type filters, and apparatus, test procedure, and results obtained are presented. J. G. H.

101. Oil cooling and oil coolers. 1. Theory of oil cooling. G. A. Montgomerie. *Sci. Lubric.*, 1957, **9** (3), 10–18.—Elements of heat transfer theory are outlined, and the significance and method of derivation of the formula for mean temp difference is discussed, together with overall, partial, and practical heat transfer coeff. 5 refs. J. G. H.

102. Study of combustion resistant hydraulic fluids as ball bearing lubricants. H. V. Cordiano, E. P. Cochran, and R. J. Wolfe. *Lubric. Engng*, 1956, **12** (4), 261–6.—While combustion-resistant hydraulic fluids when used as lubricants for bearings under heavy load are known to have resulted in reduced bearing life, general load–life relationships have not yet been fully established. Data are presented from an investigation of load–life relationship with a phosphate ester, a phosphate-ester base, and a water–glycol base with a petroleum oil as reference fluid. The apparatus and procedures used are described in some detail, and results so obtained indicate the use of over-size bearings with such fluids as the remedy for reduced bearing life. J. G. H.

103. Power loss in elliptical and 3-lobe bearings. O. Pinkus. *Lubric. Engng*, 1956, **12** (2), 110–16.—A mathematical treatment of the power losses for elliptical and 3-lobe bearings, both symmetrical and asymmetrical, with complete and incomplete oil films, is presented using Petroff's equation. Results so derived are in fair agreement with those obtained from direct experiment. J. G. H.

104. Mass and energy balance for the wear process. P. F. Chenea and A. E. Roach. *Lubric. Engng*, 1956, **12** (2), 123–5.—A mathematical treatment of fatigue wear, resulting from repeated stressing of contacting surfaces due to relative sliding, is presented, from which mass and energy balances are derived. J. G. H.

105. Lubrication at the Second International Congress of Surface Activity. Anon. *Sci. Lubric.*, 1957, **9** (4), 34–6.—Papers of lubrication interest at the Second International Congress of Surface Activity are briefly summarized. J. G. H.

106. Lubrication in the presence of nuclear radiation. J. G. Carroll and R. O. Bolt. *Lubric. Engng*, 1956, **12** (5), 305–9.—Increasing possibilities in the use of atomic energy as a power source have rendered necessary the investigation of the effects of nuclear radiation on lubricants; additional urgency has been given to the problem by the report of severe damage to conventional lubricants by such radiation. Details are presented of an investigation wherein 3 promising lubricants, di(2-ethyl-hexyl) sebacate, poly(propane oxide)-B, and octadecylbenzene with appropriate additives were subjected to low and high speed tests, both in the presence and absence of pile radiation. Procedures and apparatus employed are described in some detail: results so obtained indicate that exposure to pile radiation markedly shortens useful life of the lubricant. The compounded sebacate, although undergoing greater deterioration than octadecylbenzene, proved the better lubricant, while the poly (propane oxide) cpd proved the most satisfactory lubricant from every standpoint. J. G. H.

107. Physico-chemical investigation of engine-oil performance. A. Bondi, S. J. Beaubien, and H. Diamond. *Lubric. Engng*, 1956, **12** (4), 267–73.—Modern trends in the development of additive lub oils call for an attempted correlation of physical properties and engine operation. Procedures to this end are discussed for low temp operation, moderately low temp service, and high temp operation, with sections on bearing corrosion and corrosive engine wear. Engine test conditions and lab tests for used oil are set out in appendices. J. G. H.

108. Current research in the bacteriology of soluble oil emulsions. H. Pivnick, L. R. Sabina, R. Samuel-Maharajah, and C. K. Fotopoulos. *Lubric. Engng*, 1956, **12** (5), 310–15.—Bacterial contamination of soluble oil emulsions and synthetic cutting fluids presents difficulties resulting in breakdown of the oils and possible infection of workers with skin diseases. Wide variations in practice in the addition of disinfectants are reported both in concentrated and diluted fluids, with equivalent variations in effectiveness. Microbial oxidn and the reduction of organic sulphur are discussed, and the necessity of close co-operation between engineer, microbiologist, and toxicologist is emphasized. J. G. H.

109. Capillary viscometry of lubricating grease. L. C. Brunstrum and R. H. Leet. *Lubric. Engng*, 1956, **12** (5), 316–22.—Theories explaining the flow characteristics of lub greases are discussed and the basic mathematical treatments are considered including the Buckingham, McMillen, and Powell–Eyring equations. Of these the Powell–Eyring equation is considered to hold most promise and to call for further study. J. G. H.

110. Centralized lubrication in motor cars—the SIL system. G. Salvagnini. *Sci. Lubric.*, 1956, **8** (12), 12–15.—Emphasis is laid on the desirability of centralized lubrication for automobiles and the Bijur, Vogel, Clayton Dewandre, Tecalemit "Syndromic," and Lincoln "Multiluber" systems are briefly described, with notes on the lubricants, control methods, lubrication points, and pipes used. The SIL system first used on some Fiat models using diaphragm pumps with bodies of injected plexiglass and compressed air control is described and illustrated. J. G. H.

111. Jet engine lubricants. Chemicals or mineral oils? W. W. Gleason. *Petrol. Refin.*, 1957, **36** (7), 169–74.—The rapid evolution of high-speed jet aircraft, together with requirements for fluidity at severely low temp has introduced a need for all-synthetic lubricants, rather than conventional mineral oils. The author outlines the more important quality requirements and tests for such lubricants, namely, load carrying capacity, high temp stability, metal corrosion characteristics, volatility, and low temp fluidity. Properties of several diesters which have shown promise as synthetic oil base stocks are tabulated, and a comparison is made of the engine performance of mineral and synthetic oils in advanced design turbines. The need for a new class of lubricant possessing improved high temp stability for future aircraft is outlined, and the possibility of the re-introduction of mineral oils for this purpose is discussed. J. R. T.

112. Low temperature operation of aircraft accessories. E. A. Baniak and R. S. Barnett. *NLGI Spokesm.*, 1956, **20** (5), 9–18.—Details are presented of an investigation into the performance of greases at low temp in aircraft accessories, employing lithium and sodium soaps with synthetic oiliness components and low temp torque test equipment in an insulated cold chamber and actual aircraft accessories. Equipment and procedures used are described in detail, and results so obtained indicate that overriding factors in performance are power requirements of accessories, with as much variation in power requirements of accessory units of same design as variations in grease performance. Most effective lubricant was a lithium soap grease with a temp range of 100°–225° F, and no correlation was observed between low temp torque tests and tests on actual accessories. J. G. H.

113. Lubricating arrangements for a blooming and slabbing and a wide-strip mill. A. Diedrich and W. Niermann. *Sci. Lubric.*, 1956, **8** (8), 30–3.—Blooming and slabbing and wide-strip mills installed in the new rolling-mill plant of August–Thyssen–Hutte in the Ruhr are described in some detail, with illustrative charts of the lubricating system layouts. Full details are presented of the systems used with optimum visc for individual units and available operating records. (Translated and summarized from *Stahl und Eisen*, 19 April 1956.) J. G. H.

114. Electron microscope study of lubrication and wear. S. B. Twiss, C. R. Lewis, and D. M. Teague. *Lubric. Engng*, 1956, **12** (2), 102–8.—Results obtained employing an electron microscope with wear specimens from a friction wear apparatus, using a variety of lubricants, are presented. The friction apparatus and the electron microscope technique used are described in some detail, and the surface and particle variations encountered using straight mineral oil, ethyl palmitate, and mineral oil with 5% sperm oil added, as well as without lubricant, are recorded. J. G. H.

115. Lubrication and nuclear power plant. Anon. *Sci. Lubric.*, 1957, **9** (4), 28–30.—Papers presented at the joint ASME–ASLE Lubrication Conference in Oct. 1956 last on the causes of radiation damage, the results of irradiation, handling of waste oil, and the irradiation of greases are summarized. J. G. H.

116. Performance assessment of oils. T. G. Bold and P. W. Harrison. *Auto. Engr*, 1957, **47** (9), 366.—A new reflex method for rating oils for carbon and lacquer deposits is described and its advantages listed. D. K.

117. Some notes on the lubrication of agricultural tractors. 2. Ground drive and chassis. A. C. Smith. *Sci. Lubric.*, 1956, **8** (12), 17–23.—Methods of operation and lubrication requirements of wheel bearings, rollers, idlers, and tracks are described, and the risk of cattle disease arising from poisoning by polychlorinated naphthalene cpds used as lub additives in some American oils is discussed. J. G. H.

SPECIAL HYDROCARBON PRODUCTS

118. Quenching oils. Anon. *Mech. World*, Aug. 1957, **137** (3457), 372.—Factors relating to quenching media, used in heat treating processes, which influence metallurgical results are discussed. D. K.

DERIVED CHEMICAL PRODUCTS

119. Watch these OXO alcohols. L. F. Hatch, J. P. Thorn, and E. J. Wickson. *Petrol. Refin.*, 1957, **36** (8), 141–5.—This article discusses the higher OXO alcohols (C_8, C_{10}, and C_{13}) which have achieved a high degree of success in the short time that they have been commercially available. A schematic flow diagram for the synthesis of these alcohols from mixtures of olefins is presented, and their general physical properties are tabulated. Several of their applications are discussed, including their use as P.V.C. plasticizers, production of both non-ionic and anionic detergents and wetting agents, production of rubber modifiers, and herbicidal esters. Use of certain cpds of the higher OXO alcohols as synthetic lubricants for turbo-jet engines and also as lubricant additives for high pressure work is considered. Several other applications are briefly outlined. J. R. T.

120. The nature of vanadium in petroleum. L. K. Beach and J. E. Shewmaker. *Industr. Engng Chem.*, 1957, **49**, 1157–64.—Vanadium cpds in petroleum may be divided into 2 classes. One type probably exists in a group of monomeric, volatile porphyrins of mol. wt. between 540 and 800 and b.p. between 1085° and 1200° F. The second type appear to exist in porphyrins that are asphaltic or polymeric in structure and have higher mol. wt. The absorption spectra of these cpds are fully investigated. D. B. S.

CORROSION

121. Cathodic protection handbook. O. Osborn *et al.* *Petrol. Refin.*, 1957, **36** (6), 116–28.—This article is a condensed form of the handbook prepared by the Dow Chemical Co on the use of magnesium anodes for protection against corrosion. The practices and procedures outlined were obtained from field experience, and have been found to be workable. Included are descriptions of methods of galvanic protection of condenser and heat exchanger heads, cathodic protection of underground pipelines, and miscellaneous marine equipment. Cathodic protection costs are discussed in terms of total costs and cost per unit surface. J. R. T.

ENGINES AND AUTOMOTIVE EQUIPMENT

122. Prevention of destructive engine failure by spectrographic analysis. R. C. Linnard, C. E. Threlkeld, and R. T. Blades. *Pipe Line News*, 1957, **29** (8), 70–4; *Trans. Amer. Soc. mech. Engrs*, May 1957, **79** (4), 709–13.—Engine failure and its probable source may be predicted by keeping a check on the metals content of the engine lub oil by means of a spectrographic analysis. Oil samples should be taken at intervals of between 250 and 1000 engine hr and charts kept. An increase in any particular metal is indicative of wear in a certain part of the engine. Methods of analysing the data are described. D. B. S.

123. Particulate lead compounds in automobile exhaust gases. D. A. Hirschler *et al.* *Industr. Engng Chem.*, 1957, **49**, 1131–42.—The amount, composition, and particle size distribution of lead cpds present in exhaust gases from petrol engines using TEL were investigated. Up to 30% of the lead burned was found to be retained in the exhaust system or lub oil, and the rest was exhausted to atmosphere. The lead deposited in exhaust systems during town running was removed again during sustained high-speed running or acceleration, and this probably accounts for the low lead concn reported for city areas compared to the amount of leaded petrol used. The amount of lead exhausted also depended on the concn of TEL in the petrol, but particle size distribution and composition were independent of this. Lead was found to be present in several types of complex, and the particle size observed ranged between 0·01 μ and several mm. D. B. S.

SAFETY PRECAUTIONS

124. Static electricity as a source of fire hazards. S. Rachfal. *Nafta* (*Krakow*), 1956, **12**, 296–9.—The Polish IP has conducted some experiments on inflammability of various hydrocarbons and offer a brief summary of causes of build-up of electric charges. The remedies suggested are: damping belts to conduct electricity away, application of graphite or water–glycerine soln for similar purpose, or use of internal earthed metal brushes on the belting. Since, when these have worn, they raise the danger instead of preventing it, they should be forbidden. Hydrocarbons have high dielectric constants rising from *ca* 1 for gases to 1·9 for petrol and 2·4 for oils. Their friction, when flowing through pipes or even when circulating inside a vessel, can cause a build-up of electricity, *e.g.* 1 m/sec discharge rate of benzole resulted in a charge of 1600 V being created and a rate of 4 m/sec produced 3300 V. Pipelines with anti-corrosive coating are also insulated from earth. Earthed storage tanks dissipate to charges easily. Benzene–petrol mixture pouring into an insulated tank reached 10,000 V, and benzene–asphalt mixture running through a silk filter cloth created p.d. of 330,000 V. A remedy for such rise of potential by impact of fluid on walls of the vessel is an addition of conductive liq, *e.g.* alcohol. Gas escaping from a bottle of liquefied gas creates as much as 2000 V. List of safeguards follows. M. S.

MISCELLANEOUS

125. Control of stock losses. A. C. McGechan. *Inst. Petrol. Rev.*, Sept. 1957, **11** (129), 231–6.—Losses of product occur through evaporation, contamination, leakage, inaccurate measuring of products, and processing losses. After a discussion of the losses which occur in the production, transportation, refining, and marketing of petroleum, instruments which provide accurate readings of bulk temp and vol are described. These include a guided type of float gauge, a gauge in which the level sensing element is motor operated, an averaging thermometer giving rapid and accurate bulk temp, and a positive displacement meter. The use of various designs of seals for floating roof tanks, vapour tanks, and floating plastic blankets in the prevention of evaporation loss is described. Finally, the importance of exchange of information on loss control throughout the industry is stressed. C. B.

126. Depletion allowances in oil law. Anon. *Petrol. Times*, 27.9.57, **61** (1569), 847.—The evolution is discussed of the concept distinguishing the percentage depletion of the oil industry from the depletion allowance of those who have an economic interest in other mineral deposits or in timberland. G. A. C.

127. The place of automatic equipment in marketing operations. J. Caesar. *Inst. Petrol Rev.*, Sept. 1957, **11** (129), 252–7.—The use of automatic equipment in the storage, blending, pumping, and delivery of petroleum products is described. Remote-controlled power-operated valves, mechanical liq-level gauges, positive displacement and centrifugal pumps, and volume meters and their applications are described. One page of discussion. C. B.

128. Indonesia in retard. Anon. *Petrol. Press Serv.*, 1957, **24**, 292–5.—Various deterrents have caused great uncertainty regarding treatment of the foreign investor. The oil industry, particularly, has had to contend with many difficulties since Indonesia gained her independence in 1949. No new areas have been granted for exploration since pre-war days. One producing area in N. Sumatra has remained inaccessible to the oil company since the end of the war. In spite of trying political conditions, local production—12·5 million tons in 1956—has increased. Indonesia's place in world production has declined more than would be justified normally by the rise of her main competitor, the Middle East. Indonesia's share in supplying markets E. of Burma, including Indonesia itself, has declined from *ca* $\frac{3}{4}$ in 1938 to *ca* $\frac{1}{4}$ to-day, whereas demand in these countries has risen more than threefold from *ca* 200,000 b.d. in 1938 to *ca* 700,000 b.d. to-day. Stanvac—whose history and experience form the subject of a special study on which this article is partly based—and Caltex are making substantial investments to bring new fields in Sumatra into production. B.P.M. is preparing plans for developing a new field in Borneo. Most Indonesian crudes have a higher gravity and are sweeter than Middle East crudes, but high paraffin cont is a disadvantage. Foreign exchange is so short that recently a complete ban was imposed on imports. Loans have been negotiated with the U.S.A. and the U.S.S.R. Consumption of petroleum products in Indonesia has been rising rapidly but unevenly, and more attractive opportunities for investment exist elsewhere. R. T.

129. The use of formal training schemes as a factor in career development. R. S. Butler. *J. Inst. Petrol.*, May 1957, **43** (401), 137–42.—The paper examines the role played by formal training schemes in fulfilling training needs, and stresses that formal courses are only a part of the overall structure of a company's training activities. C. B.

130. World energy trends in relation to Australia's fuel problems. H. R. Brown. *J. Inst. Fuel*, July 1957, **30** (198), 387.—The fuel situation and power requirements in countries other than Australia are reviewed. The need for a national fuel policy, for integration of the fuel industries, and the efficient use of coal is considered. An appendix describes fuel services in countries outside of Australia. D. K.

131. Latin America's progress and problems. Anon. *Petrol. Press Serv.*, 1957, **24**, 297–300.—Economic development of all Latin American countries is related closely to their ability to import their needs of consumer and capital goods and of fuel. This ability depends mainly on vol and value of export commodities and success in attracting foreign investment capital. Last year, while most countries in the area increased their importing capacity 5 did not. Only in Venezuela, whose favourable payment balance of U.S. $220 million was the highest in Latin America, is demand for imports exceeded by continuous ability to pay for them. The main problem over the remainder of the area is to expand productivity and export earnings quickly enough to keep pace with population, which is now *ca* 178 million and increasing by more than 2% p.a. With 5 exceptions all the countries are net importers of petroleum. In 1956 total inland consumption of petroleum rose by *ca* 9·5% to over 49 million metric tons. In the 5 years 1952–56 oil demand in the area as a whole has risen by *ca* 40%. Oil imports—chiefly from Venezuela—weigh increasingly heavily on the balance of those countries unable to cover their needs from their own production. Oil meets over ½ Latin America's energy needs, and with increasing industrial activity greater demand is inevitable. A feature of the oil scene in Latin America is the participation of the states in oil exploration and production, also in refining and marketing. The 3 countries with the largest petroleum consumption—Mexico, Argentina, and Brazil—now permit only state entities to search for and develop new oil resources. R. T.

132. Effect of pressure on thermal conductivity of liquids. J. M. Lenoir. *Petrol. Refin.*, 1957, **36** (8), 162–4.—The thermal conductivity of a liq is important in the design and operation of heat exchangers. For pressure changes of more than 500 p.s.i., thermal conductivity significantly increases as pressure increases. This paper presents a generalized empirical method to account for the effect of pressure and gives data for toluene, *n*-pentane, and *n*-butyl alcohol. The method correlates the available thermal conductivity data with an average deviation of less than 2%. J. R. T.

133. First report from Gabe on desiccant performance. A. G. Harrell. *Petrol. Refin.*, 1957, **36** (8), 138–40.—Operation of the Tennessee Gas Transmission Co's refrigerated extraction plant at Gabe, Kentucky, meant removal of all moisture from the incoming gas stream before cooling the feed to −105° F. This was achieved by the use of 16 dehydrators containing a total of 260 tons of desiccants. The author presents data for the performance of several desiccants which show that silica bead and alumina pellets were the most favourable materials. Pilot plant studies of the fouling of the desiccator beds showed that the heavy ends of light oil were the major contaminants. J. R. T.

134. Disposal of soluble oil wastes. E. E. McClung. *Lubric. Engng*, 1956, **12** (31), 196–8.—Wide variations in regulations covering the disposal of soluble oil wastes are noted, and details are given of one method using aluminium sulphate for splitting and calcium hydroxide for clarification of the final waste water. Results so obtained are presented, and further possibilities are indicated. J. G. H.

135. Oil taxation. Canadian *v.* American. A. G. Burton. *Oil Gas J.*, 26.8.57, **55** (34), 107.—Pt 2 of this article deals with capital gain *v.* taxable gain, interest on unpaid tax, depreciation, and dividend depletion. G. A. C.

136. The case of M.V. *Altantic Duchess*. Anon. *Petrol. Times*, 13.9.57, **61** (1568), 791.—A survey is given of the technical evidence in the court action arising from the explosion in the *Atlantic Duchess* at Swansea in 1951 and the summing up by Mr Justice Pearson, in favour of the defendants (British Petroleum Co. Ltd). G. A. C.

137. Activity of the State Mining Council. Z. Rybak. *Nafta (Krakow)*, 1956, **12**, 308–10.—During recent meetings one of the subjects discussed was the production of fuels and wax from shales. This should go into practice in 1958. According to investigations, from one ton of shale it is possible to obtain 200 kg of combustible powder containing 100 kg of carbon, 615 kg of " semi-coke " containing 250 kg of carbon, and 352 kg of mineral matter which is 30% aluminous, also 96 m³ of gas, cal. val. 1000 k.cal/m³, 10 kg of petrol, as well as 104 kg of heavy oil much like crude oil which will yield 45 kg of liq propellant, 4·5 kg of wax, 8 kg of coke, 15 kg of phenolics, and 16 kg of rosins. Whilst consumption of all products in 1956 is anticipated at 1·7 million tons and should rise to 3 millions by 1960, the present production of crude (*ca* 200,000 tons p.a.) will in 1960 represent only less than 7% of consumption. In consequence, it is necessary to utilize all alternative sources of power and increase drilling to 85,000 m during the 5 years. M. S.

138. Current news—co-operation with Rumania. Anon. *Nafta (Krakow)*, 1956, **12**, 344.—A Polish scientific delegation visited the Rumanian petroleum industry calling at the Research Institute at Bucharest, the Central Laboratory at Ploesti, the Ploesti Petrochemical Institute, several refineries (Dermanesti, Teleayen, and Barasov), and the Methane Chemical Institute at Madias. Several of the refineries are old fashioned and equipped with Dubbs crackers, but that at Teleayen is being equipped with a Soviet-designed cracker. Drilling is done to a large extent with a turbodrill made in Rumania. Great success has been achieved in desalting crudes. M. S.

BOOK REVIEW

Mr Five per Cent. Ralph Hewins. London: Hutchinson, 1957. Pp. xix + 254. 21*s*.

Mr Hewins was very fortunate in being entrusted with the writing of the first biography of the late C. S. Gulbenkian, and more especially in being allowed not only the millionaire's own memoirs (which, after all, a good many people have seen) but also the confidence of, and invaluable personal information on an extensive scale from, the Gulbenkian and allied families; notably, of course, Mr Nubar Gulbenkian. All this, and the quite exceptional interest of the subject—by no means only to oilmen, but to all industrialists and indeed all students of international affairs—and the peculiar and unusual qualities of the hero of an astonishing " success story," should have enabled Mr Hewins to write an outstanding book; nor is it his first attempt as a biographer.

The book is disappointing. Gossip-writers and sensation-seekers have, no doubt, their place in the journalistic scheme of things, and sometimes produce stuff from which one's less elevated self is not averse; but it is wholly regrettable that the biographer of a great financier, and the

narrator of important and significant events, should be willing to borrow their arts. Mr Hewins' approach to his subject is not *sérieux*; he seems not to be writing for readers who hope to learn serious facts or views from his pages. He emphasizes, often with questionable taste, the trivial and the intimate; he overcolours his sketches, and does his hero no service (indeed, often does him serious disservice) in the process. Many passages betray a fairly complete unfamiliarity with the oil industry as it was and is, and with Middle Eastern conditions. His account of conditions in pre-1914 Istanbul borders on the absurd; his portraits of individuals are at times (as in that of Mantachoff) no more than caricatures, or are uncorrected repetitions of the misjudgments of C. S. G. himself, as in the case of Lord Greenway. The version which emerges of the highly interesting negotiations to which a part of the book is devoted is scrappy, partial, and incomplete; there is no critical analysis of Mr Gulbenkian's own account, though it patently requires one. And, while C. S. G.'s own part in Middle Eastern oil development was no doubt in fact less preponderant than he himself believed, in his egocentric reminiscences (though it was unquestionably important, and at certain moments indispensable), on the other hand the stature of Gulbenkian as a man was, most people will believe, far greater than Mr Hewins depicts. It is indeed a cardinal defect of this unsatisfying book that no clear and certainly no adequate picture of the Armenian financial Titan remains with the reader.

As to accuracy, the reader need not go beyond the legend printed below the concession-map inside the cover: it contains three errors and one quite needless misspelling. Busra should be Basra, the I.P.C. (ex-T.P.C.) Concession was given in 1925, not 1920; the M.P.C. (ex-B.O.D.) Concession dates from 1932 not 1941; and how could Iran nationalize "oil rights in the Transferred Territories" which are inside Iraq? The table of the "main stages in the evolution of the I.P.C." does not mention the great Baba Gunger oil strike of October 1927, nor the fundamental revision of the Concession in March 1931. Some of the pictures are interesting. There is no index. S. H. L.

ADDITIONS TO THE LIBRARY

Entries are in subject order arranged according to the Uren "Classification for Petroleum Bibliography," the number preceding each entry indicating the classification and corresponding to that used in the "Library Catalogue" published by the Institute. Books marked with an asterisk cannot be borrowed from the Library.

000 INSTITUTE OF PETROLEUM. Engineering progress and the oil industry: report of the Summer Meeting held at Folkestone, 29 May–1 June, 1957, edited by G. Sell. London, IP, 1957. 175 p.

080 HEWINS, R. Mr Five Per Cent: the biography of Calouste Gulbenkian. London, Hutchinson, 1957. 273 p.

080 "SHELL" TRANSPORT AND TRADING CO. LTD. Fifty-ninth annual report 1956. London, Shell, 1957. 23 p.

080 "SHELL" TRANSPORT AND TRADING CO. LTD. Survey of activities of the Shell and Royal Dutch Group of Companies, 1956. London, Shell, 1956.

080 SKINNER, W. *comp.* Oil and petroleum year book 1957. London, Skinner, 1957. 762 p.

260 CO-ORDINATING RESEARCH COUNCIL. Analysis of the 1955 road rating exchange data. New York, CRC, 1957. 93 p. (CRC report 311.)

260 CO-ORDINATING RESEARCH COUNCIL. Co-ordinating Research Council annual report for the year ending June 30, 1957. New York, CRC, 1957. 166 p.

260 CO-ORDINATING RESEARCH COUNCIL. Investigation of thermal stability of aviation turbine fuels with CFR fuel coker. New York, CRC, 1957. 114 p. (CRC report 310.)

610 BRITISH PETROLEUM CO. LTD. Hydraulic surge in airfield hydrant systems: a report based on experiments at the BP/Flight Refuelling test rig, Blandford, Dorset. London, BP, 1957.

730 AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Standard testing procedure for heat exchangers. Section 2: Shell and tube type condensers, 1956. New York, A.I.Ch.E., 1956. 16 p.

770 AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Standard testing procedure for absorbers, 1956. New York, A.I.Ch.E., 1956. 20 p.

980 IRAN. Petroleum Act, 31st July 1957. 16 p.

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OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

139. Some methods of fossil recovery from rocks. Z. Kirchner and J. Bajer. *Nafta* (*Krakow*), 1957, **13**, 29–31.—The importance of stratigraphy to search for oil and gas is well recognized. The Polish Central Laboratory of the Petroleum Industry has been using various methods for maceration of rocks to release the smaller fossils, and their experience is compared with the suggestions made in his book (*Praktikum der Angewandten Mikropaläontologie*, Berlin, 1942) by C. A. Wicher. His idea about the use of Glauber salt has been found unsatisfactory in details, and a new technique has been developed. A well cleaned sample is dried in the oven for 2 hr at 90° C, then covered with dry salt and again heated to 90° C. The rock is then "basted" with molten salt and after ½ hr heating it is treated with a small quantity of tap water and left to crystallize. This process gives results within 1–2 days, and by it 3 times as many specimens can be obtained in good condition. M. S.

140. Delaware basin—the next big boom? C. E. Barnes and E. W. Caldwell. *World Oil*, 1957, **145** (2), 68.—The Delaware basin in the W. Texas–New Mexico area is relatively undeveloped. Gas reserves are large and there are many shallow oilfields, but it is thought that there are important deep pools awaiting discovery. Drilling in the basin has been restricted by high drilling costs, poor seismic reflections, and poor con-

ditions for surface mapping, and it is said that the development of major production in the area depends on improving exploration methods.

Over 50 fields have been found in the basin, the geology of which is briefly described, and wells usually decline rapidly. Fracturing is commonly used to boost depleted production.
C. A. F.

141. Pinpointing Panhandle possibilities. C. A. Moore. *World Oil*, 1957, **145** (4), 83.—Oil possibilities of the Texas and Oklahoma Panhandle are evaluated. In these areas there are several structural provinces which are all being actively explored. Many important fields have been found along uplifts, and there has been variable success in the exploration of the basins and embayments situated between the uplifts.

In the Texas Panhandle the primary objective will probably continue to be the Pennsylvanian Morrow sand, and there are several secondary objectives. Both in Oklahoma and Texas the old areas are generally being explored for oil which was by-passed in the initial phases, and new techniques are expected to bring many marginal reservoirs into commercial production. In the less explored basin areas successful exploration will require a combination of subsurface and seismic methods. 5 refs. C. A. F.

142. New Mexico area offers thick Ellenburger pay. H. H. King. *World Oil*, 1957, **145** (4), 50.—The Ellenburger has been a main pay target in the New Mexico and W. Texas parts of the Permian basin since the discovery at Big Lake in 1928. Some of the more recently discovered Ellenburger fields are reviewed, and it is shown that they have impressive production records. The most important discovery in New Mexico in 7 years has recently been made; this is the Justin–Ellenberger field in Lea County, located from subsurface data, which, although limited in area, is important because of large potential production and a thick pay section. A map shows all the Ellenburger fields in SE. New Mexico. C. A. F.

143. Structures of south west Paradox basin. M. L. Matheny. *World Oil*, 1957, **145** (2), 63.—Recent discoveries in the Paradox basin in the Rocky Mountain area have encouraged large-scale exploration, and proved reserves in the area are now estimated at *ca* 250 million brl. All the fields are on structures, and most of them are located on NW.–SE. trends. Many of the structures show porosity development on the flanks, and beds tend to become tighter up-dip and at the crest; often there is increase in structural intensity with depth.

Almost all of the production comes from the Pennsylvanian Paradox, an evaporite series, and the main pays are porous carbonates.

28 of the fields are briefly noted, and a stratigraphic column and cross-section of the SW. edge of the basin are included.
C. A. F.

144. Basic pattern of exploration in Saudi Arabia remains unchanged. Pt 1. W. H. Thralls and R. C. Hasson. *Oil Gas J.*, 15.7.57, **55** (28), 84.—The history of the discovery and development of fields in Saudi Arabia is described. The first commercial production was at Damman in 1938, and since then there has been a series of important discoveries which has resulted in the present conservative estimate of oil reserves of 34 billion brl. Structure drilling has proved an important method of exploration in the area, together with seismic, gravity, and magnetometer techniques. Photogeology has also proved useful, with surface mapping where practicable. The application of these techniques to the major discoveries is noted, and maps showing the fields of the area and the physiographic provinces of Saudi Arabia are included.
C. A. F.

145. Petrographic and chemical investigations on the Posidonian shales of Northwest Germany. Pt 2. Investigations of the organic substance of the Posidonian shale. (In German.) H. R. von Gaertner and H. Kroepelin. *Erdöl u. Kohle*, 1956, **9**, 680–2.—Posidonian shales—bituminous rocks—differ from true bitumens by their lower solubility in org solvents. Elementary analysis is discussed. Ether extraction yields small amounts of insol—also insol in petroleum ether—sol in alcohol, with O_2 adsorption on ether evaporation. Chromatographic separation of the insol portion of the ether extract yields a substance containing 95–98% C + H, corresponding to 0·08 wt % of the shale, or *ca* 0·5% of the org substance. Soxhlet extraction followed by autoclave extraction with methanolic alkali at 200° C gives no change, at 270° C the org substance changes greatly. Subsequent extraction with H_2O and pyridine gives total extract corresponding to the substance determined indirectly. Elementary analysis of the extract gives C 71–74%, H 7·6–8·5%, N + O + S 18–22%. The calc stoichiometric formula of the org substance is C 1, H 1·4, O 0·2. The org substance is placed directly above open-burning coal in the carbonization series presented. By separation of particles $<60\ \mu$ by electrophoresis without diaphragms the material is conc to 80%, with diaphragms to max 94%. Elementary analysis of the richest fractions gives C 72·8%, H 8·87%, O + N + S 18·33%. The calc stoichiometric composition is C 1, H 1·46, O 0·19. Following complete hydrolysis of the albumenoid material in the shale with strong mineral acids, 10 amino acids were isolated and identified by chromatography.
R. T.

146. Geological structure and oil and gas discovery prospects in the territories of the German Democratic Republic. H. Kozikowski. *Nafta (Krakow)*, 1957, **13**, 61–3.—E. Germany can be divided geologically into N. lowlands and S. palæozoic regions. The N. part is not very well investigated, but work is in progress. Several gentle anticlines and synclines are known to exist. In the S. volcanic and Triassic formations are found. Most of the work so far has been done by gravimetric and refractometric methods. Traces of bitumens have been discovered at Gross Fallstein in dolomite (Permian), in Triassic structures at Rehna-Rütting, Jurassic deposits at Packensen, and in chalk at Verle. The article is illustrated by a map and is followed by numerous refs. M. S.

147. Contribution to the study of organic deposits from the Baltic: relationship between pH, Eh, and diagenesis. J. Debyser. *Rev. Inst. franç. Pétrole*, 1957, **12** (1), 3–13.—A number of long cores was obtained from the Baltic at depths of 6·5–420 m. Recent muds were found to overlie glacial deposits. The former had 2–8% of organic carbon; the latter had less than 2% and often under 1%. The water content was 50–80%. In one case detailed chemical analyses of the mineral matter were made. X-ray studies showed mineralogical similarity between the glacial and overlying deposits. Broadly there was 20–40% quartz, 1–5% alkali felspar, 5–10% plagioclases, 10–15% illite, and 5–15% kaolinite.

Detailed pH and Eh measurements were made.

It was concluded that pyrite formation is post-depositional; that there is good agreement between its theoretical stability field and its occurrence; even on a fine scale there is good agreement between pH and Eh and the chemical composition of the sediment, while alternations in the original sediment favour diagenetic evolution. G. D. H.

148. On the geological reconnaissance, appraisement, needs, and difficulties of petroleum industry in first post-war years. Z. Wilk. *Nafta (Krakow)*, 1957, **13**, 63–4.—In reply to the statement made in *Nafta (Krakow)* by the vice-president of the Central Office for Petroleum who said that there was a

great deal of ignorance on the part of the leadership in the early post-war years as to the need of elementary investigations, the author states that Schlumberger of Paris offered logging equipment, but due to the difficult financial position of the country the purchase did not take place. It has been found necessary to build Polish equipment, and this step, together with the subsequent development, shows that the importance of geological investigations has been fully recognized from the start. M. S.

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

149. Results of the marking of injection gas with radioactive methane, obtained in the Dalum petroleum field. (In German.) W. von Engelhardt and K. Muller. *Erdöl u. Kohle*, 1956, **9**, 674–9.—Geology and palæontology of the region are discussed. Porosity of the strata is investigated by injecting the radioactive C-isotope ^{14}C in the form of CH_4. The path of the injected gas is traced from behind the compressor to the head of the injection wells. The results indicate clearly the presence of permeable strata. These extend over wide areas in the region investigated and permit the injected gas to move relatively quickly. Under these conditions increasing oil yield by injecting gas is not promising, and the procedure was relinquished. Supporting charts are presented. R. T.

150. Airborne gravity surveys. H. Lundberg. *Canad. Min. metall. Bull.* 1957, **50** (544), 465–73.—Application of an airborne gradiometer to gravity surveys is discussed. In making gravity surveys from an aircraft—previously considered impossible—a ratio or a derivative of the vertical gradient is observed. By using 2 masses—as illustrated—the aircraft movements, also geographic and regional effects, are counterbalanced, only desired variations being recorded. Surveys at different elevations produce a 3-dimensional gravity pattern. By recording a derivate of the vertical gravity field a highly resolved gravity pattern is obtained directly from the records, a picture most useful to geologists in oil and mineral exploration. Effects of minor topographic variations when flying at altitudes of 1000–2000 ft do not disturb the results. Corrections must be made for major topographic features. By incorporating altitudes in the airborne routine effects of obvious topographic features can be computed immediately and eliminated. Investigations over areas which include features useful for comparison with the airborne gravity results have shown that even small ore bodies may be detected. The method will enable attention to be focused on anomalies which may yield ore. With the airborne gravity method bodies of hæmatite, chromite, manganese, and zinc may be detected which cannot be detected by any other geophysical method. The article is abundantly illustrated with supporting diagrams and anomaly patterns. R. T.

151. Digital computers can help geophysicists. T. J. Bevan and P. W. Fullerton. *World Oil*, 1957, **145** (4), 79.—Applications of digital computers to calculating procedures in the analysis of geophysical and geological data are discussed. Equipment available at present has 2 common characteristics: high speed and high cost. The high cost is offset by the high speed of computing, provided that the machine is frequently used. It is suggested that the best approach to the use of these computers is to consider first the applications in which it does essentially the same work as that carried out by hand, but in which it is advantageous because of its high speed factor and accuracy, and its ability to deal with complex calculations and use data repeatedly. 2 refs. C. A. F.

152. Geophysical activity down in Western Canada. Anon. *World Petrol.*, 1957, **28** (5), 107.—Geophysical operations in W. Canada in 1956 declined from the previous year, the greatest drop being in gravity work. British Columbia showed the largest decline in overall activity, whereas Saskatchewan showed a greater number of party hours.

Tables show geophysical activity, by areas, for 1956. C. A. F.

153. Geophysical prospecting in petroleum industry during the past 6-year plan and its future prospects. A. Kislow. *Nafta (Krakow)*, 1957, **13**, 17–20.—Work done during the last 6 years could only be termed reconnaissance, and it yielded in large areas sketchy results, whilst in some narrow areas it filled gaps. A list of regions investigated and meterage is given, together with results achieved. For the future, importance lies in planning and education. M. S.

DRILLING

154. Oilmen eye new methods in drilling. C. H. Chilton. *Chem. Engng*, 1957, **64** (8), 149–51.—A description of a new type of drill, in which drilling mud powers a hammer delivering 600 strokes/min to the slowly rotating drill head. P. J. O.

155. Here are the down-hole factors that influence casing-landing procedure. W. R. Cox. *Oil Gas J.*, 22.7.57, **55** (29), 86.—Methods of casing-landing are reviewed, it being emphasized that casing should be landed not only to prevent buckling as the cement sets, but also to prevent buckling or excessive well-head loads in later operations. In choosing the method to be used it is important to consider buckling and well-head loads on the string and to determine the freeze point. Changes in well-head load due to temp, pressure, and fluid-weight variations can occur after casing has been hung. A series of equations are presented to give a means of selecting the optimum pick-up or slack-off for most conditions. 7 refs. C. A. F.

156. Drilling breakdowns in oilfield work. K. Mischke. *Nafta (Krakow)*, 1957, **13**, 31–6.—The author analyses drilling accidents against the background of Polish safety regulations and with the help of actual statistics derived from 1953–55 operations. Several tables show the kind and severity of the various breakdowns and are followed by the author's discourse on the prevention of such stoppages. The general line of division between avoidable and unavoidable accidents should be drawn so as include in the former those due to equipment. Better educational facilities will undoubtedly help to reduce the total and duration of stoppages. M. S.

157. New equipment designed for Creole's blow-out control. J. E. Ortloff and E. H. Clark. *World Oil*, 1957, **145** (4), 100.—Special blow-out control equipment has recently been developed by Creole for use in the Lake Maracaibo area of Venezuela. The equipment is known as a Stinger blow-out control device, and consists of a cylindrical tool *ca* 10 ft long and 12 inches outside dia. It packs off from inside and provides a means of latching to the casing sub or well-head equipment while the unit is held to one side and out of the flow stream. It can then be swung out over the stream and a packer is jammed into the casing by means of a piston operated by the mud pressure. The field procedure is described, and diagrams show the details of the equipment. The tool has been tested at 7500 p.s.i; its weight is *ca* 2500 lb. C. A. F.

158. Lifting of drill from well bottom. S. Lazic. *Nafta (Yugoslavia)*, 1957, **8** (8), 231–44.—The problem of the correct timing of bit withdrawal during drilling operations is treated in this article. Using the scheme of the American specialist A. Lubinski, published in *World Oil*, June 1954, the author has analysed the limits within which the scheme can be

applied in local conditions. Since the size of Lubinski's indication of the degree of bit wear B depends on the accuracy of the values of elements P (weight on bit), r (rotary speed in rev/min), S_{MK} (rate of drilling), and T (rotating time on bottom), which must be established previously, it follows that any mistake in this establishment would show on Lubinski's indicator. As a result it would be greater or smaller than the one which would have resulted if the elements P, r, S_{MK}, and T had been established without mistakes. It is obvious that on the basis of the mistaken value of this indicator, wrong conclusions may be drawn as to whether at a certain point the bit is to be taken out of the well and replaced by a new one. In this paper the author has translated the scheme of A. Lubinski into the metric system, and then analysed the quantitative influence of mistakes, separately on the size of the indicator in question, taking into consideration that the registration system for fixing the value of the elements in question (P, r, S_{MK}, and T) has a limit of accuracy, *i.e.* a margin is tolerated in recording. In numerous cases, from experience in Yugoslavia, the author has tested the possibilities of applying the scheme to local conditions, calculating the value of the indicator of degree of bit wear on the basis of the value of separate elements, stated in corresponding reports on drillings. The author's conclusion is that the scheme may be profitably applied in local conditions as a means of determining whether the bit at the well bottom is worn out and is to be replaced, or whether only the conditions of drilling are to be altered. One should take into account how accurate the recording is, and how the elements on which the value of the indicator depends are fixed. In many of the analysed cases the values of the indicator B, calculated from the previously fixed elements depending on them, corresponded to the degree of bit wear, which were found on examination after the bits were pulled out of the wells to the surface. (Author's abstract.)

159. Inventiveness in petroleum industry—detachable crown for extraction of mud pipes. M. Ringler. *Nafta (Krakow)*, 1957, **13**, 45–6.—A crown of this design which is illustrated has the advantage of being detachable, and so it is possible to save the crown if the mud pipe cannot be rescued.
M. S.

160. Conditions for introduction of turbodrilling into Polish oil industry. J. Wojcik. *Nafta (Krakow)*, 1957, **13**, 68–71.—Before turbodrilling can be introduced workshops and repair facilities must be available. Several models of turbodrill are in existence, and only few types are suitable in Polish conditions. Otherwise the difficulties are: (1) a large quantity of mud makes it necessary to use more powerful pumps, and steel required for their parts would have to be of much higher quality than at present available in Poland; (2) consideration of well pressure leads to the need for 6⅝-inch pipes, which are not otherwise commonly in use; (3) special construction of mud pipes will be required; (4) and (5) type and dia of drilling bits will have to be suitable for the operation; (6) mud will have to be specially prepared and kept in good condition; (7) spares must be available in fair quantity, since wear of the equipment is high; (8) crews will have to be familiarized with new technique. Depth to which drilling is likely to go may reach 2500 m, and it seems that it will be more suitable to the lowlands. M. S.

PRODUCTION

161. A universal theory of oil reservoir engineering. Pt 1. Production of oil by gas depletion and water drive. S. J. Pirson. *World Oil*, 1957, **145** (4), 119.—The 3 fundamental processes by which oil can be recovered from a reservoir are discussed; these are depletion drive, water drive, and segregation drive, and any 2 of the processes may operate together. Formulæ for these are developed, and it is shown that depletion drive is relatively inefficient and its influence should be reduced as much as possible. Water drive is more efficient, and lab and theoretical studies have shown that the max recovery under these conditions occurs when field pressure is adjusted (by withdrawals) so that the gas saturation in the oil zone favours optimum replacement of residual reservoir oil by a dispersed and immovable gas phase. C. A. F.

162. Production testing of electrified wells. J. W. Lambert. *World Oil*, 1957, **145** (4), 140.—A simple production testing procedure is described for use in determining the most efficient pumping cycle for a well. The procedure consists of 3 steps: (1) the installation of a graphic water-demand meter in the motor control circuit; (2) the production is sampled at points indicated on the graphic record from (1); and (3) the determination of vol and wt of each fluid sample and its oil and water content. Diagrams showing examples of the graphic record and a chart for oil–water determinations are included.
C. A. F.

163. Recovery estimates hiked 60 per cent. R. J. Enright. *Oil Gas J.*, 22.7.57, **55** (29), 101.—A pressure maintenance project in the Todd (Deep) field, Crockett County, W. Texas, is described. The field was found in 1940, and by 1949 31 producers had been completed on 40-acre spacing. There are now *ca* 1700 acres productive, with a crinoidal reef pay ranging from 0 to 400 ft thick, and averaging 11·7% porosity and 13·6 mD permeability. The structure is an elongated dome.

Rapid development from 1944 to 1948 caused pressure decline, and this led to the water injection project which was started in 1950. Using only one injection well, the reservoir pressure has been increased, and in 1954 the reservoir was producing 8248 brl/lb drop in pressure, compared with 5620 brl in 1951. Surface facilities and the injection system are briefly noted. C. A. F.

164. A discussion of electric log interpretation in shaly sands. L. de Witte. *World Oil*, 1957, **145** (4), 114.—In a recent paper on the problem of the electric log interpretation of shaly sands it has been suggested that the results of the accumulated research on the electrochemical behaviour of shaly sands are generally invalid, and a new procedure has been proposed based on an application of the Tixier equation. These views are discussed, and it is concluded that this new procedure is based on an erroneous application of the equation and that the electrochemical theory as presented in 1955, and the resulting relationships for the interpretation of electric logs in shaly sands, continue to be in agreement with empirical observations. 7 refs. C. A. F.

165. Possible uses of electrical and nuclear diagraphy-interpretation of electric logs for clayey sands; induction logging; the laterolog. M. Martin. *Rev. Inst. franç. Pétrole*, 1957, **12** (1), 16–57.—Clays in sands act as conductors, thereby affecting the resistivity, and they do not contribute to the effective porosity. They also affect the S.P. The simple relationship giving the formation factor no longer holds. Plots of the conductivity of the saturated rock and of the contained water are linear for clean sands, but not linear, especially near the origin, for clayey sands. The resistivity relations, and the S.P. characteristics, as well as the pseudostatic S.P., are discussed, and there is a brief description of interpretive methods for clayey sands, together with appropriate charts.

The principles of the induction logging technique are outlined. The vertical and lateral investigation characteristics are described, and the influence of the hole. The effects of bed thickness and invasion are considered and examples of induction logs discussed.

The laterolog uses a directed current, permitting more precise bed definition, and is useful for getting true resistivities,

especially with saline muds. The current must traverse the invaded zone, and with deep invasion the apparent resistivity will be markedly affected by this zone. The use of the laterolog is described, and examples discussed. G. D. H.

166. The inflow of oil and gas to wells. S. Lazic. *Nafta (Yugoslavia)*, 1957, **8** (5), 137–42.—The problem of oil and gas flow from layer to well is treated in this article. The method of establishing the parameters of oil and gas flow to wells, if the flow takes place under the influence of gas dissolved in oil, is shown in one example. The optimum yield of oil for the same example is calculated, and in that case the G.O.R. should be minimal. The results of observations are shown on curves Q_o, Q_g, and G.O.R. on the corresponding graph. (Author's abstract.)

167. The results of fracturing at Lendava oilfield. L. Berdon. *Nafta (Yugoslavia)*, 1957, **8** (6), 170–5.—Since Sept. 1956, fracturing has taken place at Lendava oilfield with equipment from Halliburton Oil Well Generating Co. The Vis-o-Frac process is described, together with the successful fracturing of the first 9 wells in the Petisovci field.
(Author's abstract.)

168. Horizontal fracturing controlled by new process. Anon. *World Oil*, 1957, **145** (2), 103.—Field tests of a new process for controlled fracturing have been successfully carried out in W. Texas. It is possible to fracture horizontally in a near uniform plane and to control the point of initiation by firing a 1-inch o.d. cone charge using 8–10 g of charge followed by conventional frac treatment. The charge sets up a stress concentration by creating 2 sets of 3 holes on a horizontal plane and, when fractured hydraulically, these will break between each set of holes.

The process is used only through casing in new completions, and it can be modified for use in vertical and angular fracturing as required. C. A. F.

169. Water-flooding of water reservoir in Turasowka. Z. Bajger and S. Kwolek. *Nafta (Krakow)*, 1957, **13**, 64–8.—The particular operation was started in Jan. 1955, and during the first 23 months over 21 million cu. m has been pumped in. As a result some 2219 tons of crude over and above usual amounts have been produced. Details of porosity, and position of water table, are given. M. S.

170. Science and technique in the Soviet Union—telemechanical operation of pumping equipment taking water from underneath a river bed. P. K. Kukayev and N. D. Gordov. *Nafta (Krakow)*, 1957, **13**, 44–5.—Water for a Tuimazian well in Bashkiria which permitted better production had to be drawn from under the River Ik. 12 artesian wells are operated from a small cabin and have been working efficiently since 1954.
M. S.

171. Burn oil underground. C. H. Chilton. *Chem. Engng*, 1957, **64** (8), 152.—Underground combustion of a part of visc deposits to force oil towards well borings may depend for success on suitable rock porosity and permeability.
P. J. O.

172. Pembina pressure maintenance with water injection. J. Wahl. *World Petrol.*, 1957, **28** (5), 64.—The Pembina field in Alberta was discovered in 1953, and development has shown that the reservoir has a larger areal extent than any other in N. America. Water injection has been carried out since 1956 by several companies; 2 of these are pilot operations, but in a third project *ca* 14,080 acres (out of a total of 150,000–175,000 developed acres) have been converted to injection.

Primary depletion of the Cretaceous Cardium sand pay is by solution gas drive and no aquifer has been penetrated in the reservoir. Connate water saturation is low, and the reservoir has a high shrinkage. It is expected that pressure maintenance by water injection on a 160-acre 5-spot injection pattern will increase ultimate recovery by 2·3 times primary depletion.

The lithology and reservoir characteristics of the Cardium are given and the injection systems briefly described.
C. A. F.

173. Stimulation of Mississippi Chat in Kansas. Anon. *World Oil*, 1957, **145** (4), 145.—Acidizing and fracturing treatments have been carried out successfully, with favourable results in productivity, on many wells producing from the Mississippian Chat in Central Kansas. Some of these stimulation techniques have now become established procedures, and these are described in relation to the characteristics of the formation, which can be classified into 3 main types: (1) insoluble chert; (2) mainly chert, but with some calcium and magnesium carbonate; and (3) dolomitic rock, which is fairly soluble in acid. The effect of acidizing and fracturing on each of these types is discussed, and it is shown that fracturing has been successful in all types, but an acid treatment may be preferable if the formation has a high enough solubility. Acid stimulation is usually limited to types (2) and (3). Best results are obtained by slow treating at low pressures.
C. A. F.

174. Elements of fluid mechanics in porous media. A. Houpeurt. *Rev. Inst. franç. Pétrole*, 1957, **12** (3), 251–305.—The problems discussed include the questions of well interference and pressure build-up. In the latter case a variety of conditions are considered, starting with the assumptions that flow into the well ceases immediately on closing in, and that the well has not changed the properties of the formations. Relationships for pressure build-up in time and space are studied, as well as the behaviour when there is a constant feed at a given radius, when the reservoir is infinite, and when it is limited. There are worked examples of the use of some of the relationships.

Finally, modifications required by practical considerations are examined, including skin effects, recompression, the presence of a tight fault near the well, giving a non-circular drainage area, and the use of surface pressures. G. D. H.

175. For more oil, propane flood. C. H. Chilton. *Chem. Engng*, 1957, **64** (8), 152.—A new method of secondary recovery known as miscible-phase displacement involves injection of liq propane or butane, and is reported to give higher recoveries than water flooding. P. J. O.

OILFIELD DEVELOPMENT

176. July's wells hit new peak as drilling gains momentum. C. W. Smith. *World Oil*, 1957, **145** (4), 74.—A total of 4878 new wells were completed in the U.S.A. in July 1957, *ca* 600 more than in the previous month, but 300 less than in the same month of 1956. Drilling in July was at a higher rate than in previous months of the year, and the total number of wells for the first 7 months of the year was 30,954, 9·2% less than the total for the corresponding period of 1956. Tables show U.S. drilling activity in July 1957 and first 7 months, 1957–1956, by states and districts, and summaries of U.S. drilling activity. C. A. F.

177. Utah's Paradox takes its place among the big ones. F. J. Gardrer. *Oil Gas J.*, 22.7.57, **55** (29), 157.—There is active exploration in the Paradox basin in Utah, U.S.A., where 16 fields have been found, of which 8 have been discovered this year. Wildcat success ratio is *ca* 1 : 5. The main field is Aneth, which is producing from the Pennsylvanian Paradox at *ca* 5800 ft.

Ca 5000 b.d. are being produced from the area, and a new pipeline to the W. Coast is planned to operate from early 1958. This will have an initial capacity of 70,000 b.d. and a potential of 160,000 b.d. C. A. F.

178. Test breaks record. Anon. *Oil Gas J.*, 22.7.57, **55** (29), 55.—1 Sterba–Ordovician in Caddo County, Oklahoma, the deepest well in the state, has reached 18,369 ft in a sandy shale section, probably Mississippian. The projected depth is 20,000 ft, and the well is located on the S. flank of the Cement field structure. The deepest producer in Oklahoma is 1 Reed, in the Knox field, Grady County, which produces from the Third Bromide at *ca* 15,600 ft. C. A. F.

179. Ventura basin—scene of new deep drilling activity. W. T. Smith. *Oil Gas J.*, 15.7.57, **55** (28), 166.—There has been a revival of drilling in the Ventura basin of California, the main targets being the Sespe in the W. part of the basin, in the W. Montalvo and Oxnard fields, and accumulations associated with the Oakridge fault in the E. part. The main activity in the Oakridge area is in the Saticoy field and the Bridgepool area of the S. Mountain field. In both areas the Pico is found productive below the Oakridge thrust in beds dipping steeply and at depths ranging from 6500 to 9500 ft.

There have also been developments in the Fillmore field in Santa Clara valley, where the main production is from the Pliocene Spalding sand at 14,000–15,000 ft, and offshore work has been carried out at Summerland and Rincon. C. A. F.

180. Eastern Canada: oil and gas production sharply higher. Anon. *World Petrol.*, 1957, **28** (5), 116.—Production in E. Canada in 1956 increased by 14% to 1680 b.d., with natural gas increasing by 21% to 13·3 billion cu. ft. Drilling activity also increased, and in the Quebec area there has been active structure drilling and geophysical reconnaissance. Wildcats were also drilled in the Quebec area of the St Lawrence lowlands, and one of these found gas in the Ordovician. In the Maritimes gravity surveys were carried out and a few wells were drilled.

Most of the drilling has been in SW. Ontario, where 420 wells were drilled. Wildcats were 10% successful in this area and development wells 69% successful. Much of the development drilling was in the Clinton–Medina gas area. Offshore work is being carried out in Lake Erie. C. A. F.

181. Exploratory developments in Western Canada in 1956. F. K. Beach. *World Petrol.*, 1957, **28** (5), 83.—There was increased exploration and development drilling in W. Canada in 1956 and a total of 3282 wells were drilled during the year. Over 800 wells were drilled in the Pembina field in Alberta, and it is expected that the field will be largely developed by the end of 1957.

In Saskatchewan drilling has been concentrated in the SE., and in British Columbia most drilling was in the Fort St John field. Only 4 wells were drilled in the NW. Territories, in the Norman Wells field.

Important finds include granite wash oil in NW. Alberta, where a discovery led to extensive leasing.

Several tables show statistics of drilling and field development. C. A. F.

182. New discoveries add to Canadian reserves. W. B. Gallup and R. S. Buckland. *World Petrol.*, 1957, **28** (5), 61.—Oilfield developments in W. Canada in 1956 are outlined. It was a record year for exploration, with a discovery rate of 1 : 5. Reserves were increased by 373 million brl, of which ⅓ was found in SE. Saskatchewan. Drilling activity increased by 20% over the previous year. A map shows the areas of development of main interest; these are Boundary Lake, Red Earth, Virginia hills, Cutbank, and High River. In the tar sands area there have been experiments using a centrifuge process for extraction. Tables show reserves, production, and drilling activity in Canada in 1956. C. A. F.

183. Manitoba still hoping. Anon. *World Petrol.*, 1957, **28** (5), 101.—Exploratory and development drilling has been declining in Manitoba, and only one field was discovered in 1956, compared with 10 in the previous year. 262 wells were completed in the state in 1956.

Operations have stressed the importance of the 3 main fields: Daly, Virden-Roselea, and N. Virden. In 1956 these produced 90% of the production, and all were being developed during the year.

Production during 1957 is expected to average *ca* 15,000 b.d., which is little more than ½ the equivalent of local refining requirements.

Transport facilities and leasing activities in the state are noted. C. A. F.

184. Saskatchewan active in 1956. R. R. McDaniel. *World Petrol.*, 1957, **28** (5), 108.—Production in Saskatchewan in 1956 increased to an average of over 80,000 b.d. in Dec., and drilling activity was at a record level. The major part of the increase in production has been in light-gravity oils.

Most of the increased activity has been in the SE. part of the state, particularly along the Mississippian Charles trend, including the Weyburn, Midale, Steelman–Kingsford, Oxbow, and Florence–Carnduff fields. Development has also continued in the Coleville area of NW. Saskatchewan, where heavy oil is produced.

Several secondary recovery projects are operating; the largest is in the Dollard field in the SW. part of the state, where water injection has boosted production from 800 to 5200 b.d.

There have been further developments in the gas distribution system, and it is anticipated that a large area of the province will be served by natural gas in the near future. C. A. F.

185. Sound economics in Saskatchewan. L. O. Rowland. *World Petrol.*, 1957, **28** (5), 80.—There has been intensive exploration and development drilling in SE. Saskatchewan since late 1954, and factors which have led to and encouraged this activity are discussed, such as low development costs, a year-round drilling programme, and adequate pipeline facilities communicating directly with an expanding market in the Ontario area.

SE. Saskatchewan has relatively shallow pays, averaging from *ca* 4000 to 5000 ft in depth, and wildcat success ratio has been very high; of 116 wildcats drilled in 1956, 41 found oil. Only one formation has proved oil-bearing, the Mississippian limestone, which includes the Charles and Mission Canyon pays. C. A. F.

186. Canadian gas developments. F. K. Beach. *World Petrol.*, 1957, **28** (5), 70.—Developments in the transport and supply of natural gas in Canada are discussed. 2 major pipelines are being completed on opposite sides of the country; one of these, expected to be delivering gas in 1957, will run from the Peace River area to the Pacific coast, and the other will run through Ontario to E. Canada. Gas reserves are large, and the supply appears to be adequate to meet a growing demand for gas for heating and for use in petroleum chemicals. By-products include sulphur and LPG, and a plant is to be built at Red Deer to manufacture butadiene. A substantial increase in the market for gas burning appliances is anticipated. C. A. F.

187. South zone bright spot in Mexico. L. M. Gasche. *World Oil*, 1957, **145** (4), 151.—Successful drilling has continued in the S. Zone in the Isthmus of Tehuantepec in Mexico. There

are now 21 producing fields in the area with *ca* 500 producing wells, and an extensive exploration programme is being carried out, especially in Veracruz and Tabasco.

Well depths vary from *ca* 500 to *ca* 9000 ft, and one of the deepest fields is Jose Colomo, which has been recently developed. An absorption plant is being built here with an output potential of 16,000 b.d.

Pays in the S. Zone are all sands, and the 2 main production problems are corrosion and wax formation. Mechanical scraping and steam injection are necessary to combat the latter.

Communications and social facilities in the area are briefly noted. C. A. F.

188. Bolivia oil interest warming up. Pt 2. Bolivian Gulf wildcat to test YPFB concession acreage. E. T. Mauri. *World Oil*, 1957, **145** (2), 142.—An exploration well is to be drilled in a concession of YPFB, the national oil company, which is one of 2 areas covered by development agreements with private companies. Airborne magnetometer and photographic surveys, together with gravity surveys, have been carried out in the area.

Oil development in Bolivia has been on a small scale, and all production has come from Devonian and Permo-Carboniferous sands in anticlinal structures. A total of 6 fields is listed, the largest being Camiri, with 72 producing wells and cumulative production (to Dec. 1956) of over 11 million brl. Total production from all the fields in 1956 was *ca* 8000 b.d.

Combined crude throughput of all the refineries in the country is *ca* 12,000 b.d., and there is a pipeline network covering 765 miles extending from the Argentine border to La Paz. Further lines are being built.

The geology of the sub-Andean sedimentary basin in Bolivia is described briefly; this is the area of oil interest in the country, and beds range from Cambrian to Tertiary. C. A. F.

189. Khursaniyah reserves may exceed billion barrels. Anon. *World Oil*, 1957, **145** (4), 164.—The reserves of the Khursaniyah field in Saudi Arabia are believed to exceed one billion brl; the third well has extended the field 3 miles SSE. of the discovery well.

At Damman a gas well has been completed in the Permian at *ca* 10,200 ft.

Ca 25 wells are expected to be completed in Saudi Arabia in 1957. C. A. F.

TRANSPORT AND STORAGE

190. The distribution of petroleum products. T. W. Mathias. *Petrol Times*, 11.10.57, **61** (1570), 901.—Patterns of distribution in 1950 and 1957 are compared, economics of laying-down stocks, the "big unit," max utilization of equipment, the "leap-frog" system, pipelines, design of distribution centres and their equipment, and future developments are among subjects comprehensively discussed. G. A. C.

191. Radioisotopes. S. D. Boynton. *Petrol. Process.*, 1957, **12** (8), 55–8.—A fixed radioisotope source can give details of sediment in lines, checking liq levels in vessels, detect faults in cat cracker operation, etc. 2 data sheets for CO-60, Cl-137, and Ir-192 are given. J. H.

192. First U.K. methane shipments will be made in converted insulated tankers. Anon. *Chem. Age*, 5.10.57, **78**, 552.—The Gas Council have chartered an converted tanker which will carry an experimental cargo of methane from S. America. The tanker will not be refrigerated.

Methane may become an economic chemical intermediate. R. T. T. B.

193. Texas Eastern's Mount Pleasant station features single unit. E. Sterrett. *Pipe Line News*, 1957, **29** (9), 39–43.—This station, on a 30-inch natural gas pipeline, employs a single 15,000-h.p. electric motor driving a single stage centrifugal compressor to give the 1·5 C.R. to carry the gas along the line. Details of the station equipment and its operation are given; also a diagram of the main piping of the station. Total cost was $1,710,530, with an indicated $114.04 per installed h.p. D. K. R.

194. Hydraulics for pipeliners. Pt XXV. Pipeline economics. C. B. Lester. *Pipe Line News*, 1957, **29** (8), 20–6.—Pipeline economics and considerations to be taken into account when designing pipelines are discussed fully. Sections are included on taxation, valuation, capital costs, operating costs, depreciation, etc. D. B. S.

195. Pipeline-flow efficiency testing. R. F. Bukacek and R. T. Ellington. *Oil Gas J.*, 23.9.57, **55** (38), 114.—Pt 2 discusses equations required for calculating flow efficiency and illustrates their use in a worked-out case. G. A. C.

196. Pipeline transports gilsonite solids. R. K. Bond. *Oil Gas J.*, 7.10.57, **55** (40), 181.—Design and operation of the 72-mile, 6-inch pipeline of American Gilsonite Co are discussed. 700 tons/day of gilsonite solids are transported in the form of a water slurry. G. A. C.

197. American gilsonite pipeline successfully handles slurries. E. Sterrett. *Pipe Line News*, 1957, **29** (9), 49.—The economy and convenience of transporting gilsonite as a slurry are discussed, together with the preliminary research and the design basis of the pipeline. The 6-inch pipeline, operating at pressures of up to 2200 p.s.i. in order to attain an elevation of 8500 ft, transports *ca* 700 tons of solid per day, a distance of 72 miles. D. K. R.

198. An all electric control system for maximizing flow through a multiple station pipeline. B. E. Ewers and H. B. Bath. *Pipe Line News*, 1957, **29** (9), 44–8.—An automatically operated unattended pumping station which has additional remote control features is described. Details of a typical station are given, with a control and flow diagram. The economy of unattended pipeline stations having the reliability of electrical operation is stressed. D. K. R.

199. Chemical control of vegetation on pipeline rights-of-way. N. G. Wilson. *Pipe Line News*, 1957, **29** (9), 22–8.—Control of vegetation on pipeline and other rights-of-way by use of chemicals is discussed, with special regard to the costs of materials and application as against the more conventional methods. Examples of control of various types of vegetation are quoted, giving details of the chemicals used. D. K. R.

200. Rock work doubles spread costs in Canada. W. Quarles. *Pipe Line News*, 1957, **29** (9), 30–8.—The difficulties encountered by contractors due to building a pipeline through granite in Canada are reported. The special equipment necessary, which cost one contractor alone an estimated $¾ million, has nearly doubled costs on the eastern "leg" of the Trans-Canada Pipeline natural gas system. D. K. R.

201. Storage of petroleum products. P. Lipka. *Nafta (Krakow)*, 1957, **13**, 24–6.—Shortage of storage space in Poland is becoming more severe as times goes on, since whilst the needs of the industry and agriculture are increasing, the

funds assigned for expansion of storage capacity are small. The opinion that capacity in excess of transhipment (temporary) storage is unnecessary is ill-founded, since sea-based supplies make it imperative that 2 months' stocks should be held. Tank farms in Polish ports are badly situated, and their capacity must be expanded. This would take care of the fact that in winter consumption is 55% of the yearly consumption. M. S.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

202. The complete technical story of the world's most modern refinery. W. F. Bland *et al.* *Petrol. Process.*, 1957, **12** (7), 99–170.—A comprehensive survey of new 130,000-b.d. refinery for Tidewater Oil Co. It is designed to use low gravity crude of high sulphur content and give max yields of dist fuels. No lubricants or asphalt are produced. This is achieved by sending the vacuum residuum of crude unit to a 42,000-b.d. fluid coker, which makes gasoline and gas oil feed to the cat cracker. The small yield of coke is marketable. Sulphur is removed as H_2S during cracking and Unifining with reformer and manufactured hydrogen. All naphthas pass through a solutizer. Cat reforming reduces unsaleable heavy gasolines. All light ends are collected and processed in a single plant, which recovers 85% of C_3 and all heavier fractions. The C_3–C_4 fractions pass to polymerization, and alkylation plants are also given. To minimize pollution the only buried lines are those for water and electrical conduit. Toxic and odorous gases are vented in stacks, which vary in height from 175 to 350 ft. Pneumatic instruments are favoured, and a logging–scanning information system is integrated with the conventional control panels. Materials of construction to withstand the various corrosive conditions are listed. Short articles on site selection, administration, etc., are included. J. H.

203. How isotopes work for refiners. G. Weber. *Oil Gas J.*, 23.9.57, **55** (38), 91.—Examples of use of isotopes in petroleum industry include measuring liq level, rate of flow of liq, marking of interfaces in lines, detection of leaks. A dual purpose reactor will make possible radiation processing. G. A. C.

204. Centrifugal pump packings and seals. Pt 5. Packing maintenance. H. Woodhouse. *Petrol. Refin.*, 1957, **36** (6), 193–7.—This article deals with the installation and maintenance of pump packings. Methods of installing new packing rings are described, and packing lubrication is discussed in some detail. The main troubles which occur in practice are listed, and their cause and cure outlined in tabular form. Information on the choice of the basic packing material for 10 different media is tabulated. J. R. T.

205. Compressor stations go modern. M. J. Paul. *Oil Gas J.*, 7.10.57, **55** (40), 144.—Remotely controlled blowdown systems, modified closed water-cooling systems, supercharging compressor engines, exhaust timing of aux engines, and exposure of manifold piping are points concerned in the 5 major modernization programmes carried out by National Gas Pipeline Co of America. Diagrams are given. G. A. C.

206. Bottleneck removal in refineries. L. Resen. *Oil Gas J.*, 7.10.57, **55** (40), 123.—42 separate items are given, each dealing with a typical bottleneck situation and its solution. Dist, heat exchange, pumping, cat cracking, foaming, and frothing are included in subjects; and a diagram accompanies the text on each problem. G. A. C.

207. Pressure concrete pipe handles corrosives. R. B. Norden. *Chem. Engng*, 1957, **64** (8), 300–2.—Prestressed concrete pipes containing wire-wrapped steel cyl are in use in the U.S.A. for carrying sea water and other corrosive liq at pressures of 50–300 p.s.i. They cost less to install than steel pipe, and have welded joints, but cannot be cut easily in the field, and must therefore be prefabricated. P. J. O.

208. Low-finned exchanger tubing. Pt III. R. G. Newell. *Petrol. Process.*, 1957, **12** (4), 77–81.—Methods are described for designing units for forced convection heat transfer on shell side without change of phase. H.T.C. are given by modifying the Donohue method. A pressure drop correlation and data on variation of fouling factor with time are quoted. J. H.

209. 1957 refinery process glossary. G. H. Unzelman and C. J. Wolf. *Petrol. Process.*, 1957, **12** (5), 97–152.—Brief descriptions of principal processes used currently in N. American refineries. Bibliographies and introductions to each general type of process are included. J. H.

210. Butadiene plant makes big news. Anon. *Petrol. Process.*, 1957, **12** (8), 67–9.—Brief description of first butadiene plant built in the U.S.A. since the second world war. The twin-purpose design enables aviation gasoline alkylate to be made, when production of butadiene is cut back. Under these conditions plant produces 64,800 tons/hr of diene of 2·5 M tons/hr alkylate. The dehydrogenated feed of *n*-butane and recycled butylene is pre-stripped with naphtha to recover all the diene. After depropanizing, the diene stream is extracted with furfural. The alkylation section is a conventional sulphuric acid plant. *iso*Pentane is used to blend with the alkylate to make finished gasolines. J. H.

211. Automatic process-data handling. C. H. Chilton. *Chem. Engng*, 1957, **64** (8), 148–50.—A discussion of the $1 million installation at Tidewater's new Delaware refinery, which automatically scans hundreds of variables at 5 per sec, logs important ones hourly, and provides averaged or integrated values for accounting purposes punched on tape. A digital computer is built into the data-handling system of the tank farm, giving No. of brl in the tanks at 60° F. P. J. O.

212. Low temperature insulation. R. Cannon. *Petrol. Process.*, 1957, **12** (6), 98–112.—Insulation of plant operating at sub-zero temp presents problems different from those met in hot installations. Water vapour diffuses into the insulation, will condense when cooled to its dew point, and eventually freeze. The effect is cumulative, and the lagging will eventually lose its insulating properties. Satisfactory materials include fibrous, granular, and cellular cpds and reflective insulation. The characteristics of these are listed. The importance of a vapour barrier applied externally to the base insulation is emphasized. Whenever the insulation is subjected to drip from local conditions, a weather barrier over the vapour barrier is required. Methods of preventing ice creep along metal projections and pipe hangers, etc., are described. Charts to determine lagging thickness and notes on storage and maintenance are also given. J. H.

213. Flexibility in Unifining. Anon. *Petrol. Times*, 11.10.57, **61** (1570), 917.—The Unifining plant of Tidewater Oil Co, Delaware, with a design capacity of 88,000 b.d. consists of 5

units to take in the widely varying characteristics of the available streams and extensively used purification by hydrogen. Tables show properties of charge stocks and products.

G. A. C.

214. Biological method of purification of cresol effluents from refineries. A. Luchter. *Bull. Polish Inst. Petrol.*, 1957, **7**, 1 (Suppl. *Nafta* (*Krakow*), 1957, **13**).—On small and large pilot plants work was done on the subject of biological methods of purification by the Polish IP. 2 troughs were employed and bacteria spacially bred at the Institute were used. Although the figures quoted in tables appended are not consistent in detail, in general the reduction of cresolic content varied from *ca* 99·7 to 96·0% in small pilot scale work, and on the large scale, when water was recirculated, reduction was between 100 and 66·7%. The higher the cresol content, the worse the result. M. S.

DISTILLATION

215. Transients and equilibration time in continuous distillation. A. Rose, C. L. Johnson, and T. J. Williams. *Industr. Engng Chem.*, 1956, **48**, 1173–9.—The length of the transient period or equilibration time was found to be a function of the sharpness of the separation obtainable. The equilibration time was longest when a feed composition giving the best separation at the existing column operating conditions was used; the period shortened, however, when this feed composition changed. Increasing the column efficiency also increased the equilibration time and made the system more susceptible to changes in the feed composition.

D. B. S.

ABSORPTION AND ADSORPTION

216. " Marginal operation " pays off in trend-setting lean gas plant. R. Cannon. *Petrol. Process.*, 1957, **12** (8), 62–5.—Lean gas plant briefly described profitably operates with inlet gas moisture less than 1 gal/M cu. ft. Inlet gas is chilled to −10° F and absorption takes place at 950 p.s.i. max. The fuel requirements are less than 1·3 vol % of gas charged.

J. H.

217. Adsorption isotherm for propane and *iso*- and *n*-butane on activated carbon. M. Martynek. *Bull. Polish Inst. Petrol.*, 1957, **7**, 2 (Suppl. *Nafta* (*Krakow*), 1957, **13**).—Polish, Hungarian, and Czech carbons were tried at temp ranging from 0° to 50° C, pressures from 1 to 20 atm and at concn from 10 to 200 g/cu. m., and the results showed that low temp and high pressures help adsorption, but excessively high pressures are very expensive in equipment. M. S.

SOLVENT EXTRACTION AND DEWAXING

218. Extraction of tar oil from impregnated woods. H. Mallison *et al.* *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (4), 141–5.—Experiments are described on solvent extraction of tar oil on samples of freshly impregnated beech and pine sections, and untreated samples for comparison. Old tar oil-impregnated woods included are: old beech beam (20 years life) and old pine rod (duration 25 years). Tabulated results show that solvents used, $CH_3{\cdot}OH$, $CHCl_3$, C_6H_6, C_5H_5N, $C_6H_5{\cdot}CH_3$ remove all tar oil from new wood. The quantity of oil remaining in old wood is unknown. Also, various tar resins are formed whose solubility varies, the insol ones are not extracted. A universal solvent which removes all the tar oils and tar resins is non-existent, thus only extractable tar oil is obtained. Not only is tar oil extracted, but some wood constituents. Their separation is not expedient. 16 refs.

R. T.

219. Technology of obtaining and refining resin. W. Huntenburg. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (3), 106–7.—Pt 3. Continuation of review of resin production from conifers by solvent extraction. Wood is treated with aq alkalis. Tall oil, a by-product from chem wood pulp, and its uses are discussed, with relevant patents. 13 refs. R. T.

220. Some aspects of the extraction of hydrocarbon mixtures with polar or with non-polar solvents. H. Mondria. *Ingenieur, 's Grav.*, 24.5.57, **69** (21), M 1–7.—After an introduction on the general status of the theory of solubilities, an attempt is made to explain qualitatively the effect of temp pressure, and hydrocarbon composition on extraction results. Single-stage batch extractions are discussed next, with special emphasis on the different behaviour of polar and non-polar solvents. For countercurrent extractions with a single solvent, a stepwise graphical method is described, showing the influence of the number of stages on the extraction results. A general formula is given, showing the effect of solvent impurities. G. F. T. C.

CRACKING

221. Graphical statistical methods for studying catalytic processes and characterization of catalysts by parameters. H. I. Waterman. *Ingenieur, 's Grav.*, 14.6.57, **69** (24), Ch 87–2.—It has been proved recently that the activity of a cat can be characterized by a certain number of parameters according to a very simple method of graphic representation. This considers the 3 most important actions of the catalyst, *i.e.* the conversion of the starting material, the formation of the derived products, and the side reactions. According to this method, many chemical processes in which selectivity problems are involved can be represented graphically as *pseudo*-ternary systems, the components of which are: the unconverted starting material A, the desired product B, and the by-products C. The course of the reaction can be plotted on a triangular diagram. It has been found that the concn change of the 3 components as a result of the change of one reaction variable can be represented by an equation of the second degree in which 2 constants characterize the performance of the cat under the given conditions. 8 figs, 6 refs.

G. F. T. C.

222. The " H-Oil " process. H. Pichler *et al.* *Oil Gas J.*, 30.9.57, **55** (39), 109.—The process, developed by Hydrocarbon Research Inc, employs a specially designed reactor, in which the cat bed is operated essentially isothermally. Refinery residual stocks are thus reduced to plant fuel requirement, and process converts the remainder into dist products.

Flow sheets are given, and tables show economics of the 14,000-brl and 5000-brl plants. G. A. C.

223. Fluid catalyst design data. Pt 3. Minimum velocity for catalyst flow. F. A. Zenz. *Petrol. Refin.*, 1957, **36** (6), 133–42.—This article is concerned with flow characteristics in both horizontal and vertical conveying. Correlations to determine saturation carrying capacity, and for the prevention of saltation in horizontal tubes and choking in vertical tubes, are presented. The usefulness of such correlations in the design of air lift TCC units is pointed out, and their application to analysis of entrainment is discussed. J. R. T.

224. Catalytic cracking of petroleum residuum. P. H. Johnson, C. R. Eberline, and R. V. Denton. *Industr. Engng Chem.*, 1957, **49**, 1255–8.—Yields of dist oil and gas oil from crude oil may be increased by cat cracking residue at the expense of production of residual fuel oil. The Ramsbottom carbon residue was found to give an indication of the amount of residuum which could not be cracked to liq products, this quantity being a function of the amount of carbon being deposited on the cat. The use of process steam was found to

improve the yields of liq products, whilst cat contamination by heavy metals reduced the yield slightly and at the same time increased the hydrogen and carbon production.
D. B. S.

225. Chemical reactions involved in cracking hydrocarbons. K. Kachlik. *Nafta (Krakow)*, 1957, **13**, 72–7.—A review of processes and changes occurring in the charges of various dist range, together with the energy consideration involved.
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226. Thermal diffusion efficiency and separation of liquid petroleum fractions. J. R. White and A. T. Fellows. *Industr. Engng Chem.*, 1957, **49** (9), 1409–19.—Separation of petroleum and hydrocarbon mixtures by thermal diffusion is limited commercially by the low thermal efficiency of the process. To investigate whether this low efficiency is due to the mol nature of the process or inadequate apparatus design, 2 vertical thermal diffusion columns were constructed to measure the heat required to separate various binary mixtures. The thermal efficiencies of the 2 columns were found to approach the estimated thermodynamic limits for 2 test mixtures. The heat dissipation in separating various petroleum fractions was then determined. D. K. R.

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SPECIAL PROCESSES

228. Contribution to the question of gas liquor evaluation. I. Possibilities of recovering coke plant nitrogen and sulphur by the indirect process. (In German.) G. Rühl. *Brennst-Chemie*, 1957, **38** (1–2), 27–32.—The position of the technique of recovery and utilization of gas liq—based principally on current patent literature—is reviewed. 113 literature refs.
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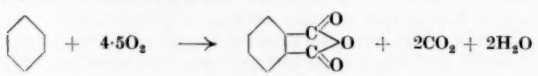
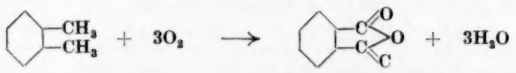


o-Xylene is converted according to the equation:



Great importance attaches to operation under mild time/temp conditions. A cat is necessary, V_2O_5 with a carrier K_2SO_4, silica gel, or Al_2O_3 is used. The working range is between 350° and 450° C. To attain the desired conversion and keep the hydrocarbon concn below the explosion limit, air addition must greatly exceed the stoichiometric according to the above equations. Fixed and fluidized bed cat are compared. Important controllable reaction conditions are: cat choice, temp, air–hydrocarbon ratio, and space velocity.
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J. H.

231. Preparation of lubricating oil additives from dimercaptothiadiazole. E. K. Fields. *Industr. Engng Chem.*, 1957, **49** (9), 1361–4.—Lub oil additives prepared from dimercaptothiadiazole inhibit corrosion of copper–lead bearings, and are non-corrosive to, and prevent active sulphur corrosion of, silver bearings. Description of preparation of derivatives is given; also tables of yields, properties, and analysis of the derivatives. Test results for a typical member of each of 5 classes of derivatives are given. D. K. R.

232. Synthesis of hydrocarbons from carbon monoxide and steam. Communication III: synthesis on cobalt catalysts. (In German.) H. Kölbel and E. Vorwerk. *BrennstChemie*, 1957, **38** (1–2), 3–8.—Results are reported on the direct conversion of CO with steam on the Co–ThO_2–MgO–kieselguhr cat of the Fischer–Tropsch synthesis as model cat. Consideration is given—especially from a tech viewpoint—to the influence of operating conditions, temp, gas composition, and space velocity at normal pressure, in some cases in the medium pressure range up to 16 atm. By choosing suitable operating conditions the yield-reducing secondary reactions—conversion with H_2 formation, CH_4 formation, and CO decomp with C separation—are suppressed almost completely. Optimum ranges for the cat used are: temp 200°–240° C, CO–H_2O ratio 3 : 1–1 : 1, especially 1·5 : 1–2 : 1, space velocity for normal pressure 10–50, according to the other operating conditions, preferably so that CO conversion in a single passage = 70–80%. Basically, the synthesis from CO and steam with the same cat requires—compared with the Fischer–Tropsch synthesis—sharper reaction conditions. In spite of this, almost exclusively higher hydrocarbons are formed. CH_4 formation is very small, and can be obviated almost completely by using medium pressure. 27 literature refs.
R. T.

233. U.S. Patent No. 2,796,327. Anon. *Petrol. Process.*, 1957, **12** (8), 107.—Brief notes on a process which produces carbon black particles suspended in gas of H_2, CO, C_2H_2, and water vapour by complete combustion of a hydrocarbon in a free-oxygen containing gas. Ammonia is injected to react with the carbon monoxide to give hydrogen cyanide, some of which further combines with the acetylene to acrylonitrile.
J. H.

METERING AND CONTROL

234. Equations simplify fluid metering. E. R. Lynch and J. Schoenberg. *Chem. Engng*, 1957, **64** (8), 259–62.—The equations given enable the size and cost of the most efficient differential producer to be determined. They cover vol and mass flow of liq and gases, for orifice, Venturi, and other types of meter.
P. J. O.

235. How to meter highly volatile liquids. G. E. Batchelder. *Petrol. Process.*, 1957, **12** (8), 70–3.—Highly volatile liq vaporize readily on metering under slight increases in temp and reduction of pressure. This can occur through overheating, use of indirect and too small lines, restriction of flow in fittings, overheating, and unnecessary agitation. Procedure is listed to avoid these causes. Most systems use a vapour return line. If a differential valve is placed on this line, a back-pressure can be set up to avoid vapour carry-over from the receiver to the supply tank. J. H.

236. Calculate fluid flow by basic equations. L. M. Polentz. *Chem. Engng*, 1957, **64** (8), 282–6.—The author discusses the calculation of gas flow through pipeline orifices and nozzles, taking into account compressibility of the fluid. P. J. O.

PRODUCTS

CHEMISTRY AND PHYSICS

237. Equations of state. The application of orthoganol polynomials. C. J. Pings, Jr., and B. H. Sage. *Industr. Engng Chem.*, 1957, **49**, 1315–28.—An equation of state from which volumetric behaviour of pure hydrocarbons, in both liq and vapour phases, and enthalpy changes can be predicted was developed using open-ended series of orthogonal polynomials. The accuracy obtainable is comparable to that for the experimental data available, and an example is given in which the equation is applied to propane at pressures of up to 10,000 p.s.i. and temp between 40° and 460° F, and predicts behaviour with an average deviation from the experimental of only 0·27%. D. B. S.

238. Use of iron filings in a high viscosity medium for mapping approximate magnetic field shapes. J. B. Rechen and J. C. Jordan. *Rev. sci. Instrum.*, 1957, **28**, 584.—The use of a thin coating of high visc (65,000 cS) oil on a copper sheet, to which iron filings are then applied, enables the filings to align themselves slowly with the magnetic lines of force, and they are then not prone to fly to the magnet. Further, the pattern remains indefinitely after the magnet source has been removed. H. C. E.

239. Performance index for gas chromatographic columns. M. J. E. Golay. *Nature, Lond.*, 1957, **180**, 435.—Theoretical studies indicate that the performance index may be defined as

$$\frac{(\Delta t)^4 t' \Delta p}{t^3(t - 0{\cdot}75t')}$$

where Δt is the (time) width of the " band " at mid height, t and t' are the times after injection to centres of " air peak " and band respectively, and Δp is the pressure drop along the column. The formula has the dimensions of visc.

Theory indicates that the index of an ideal column should be of the order 0·1 poise; in practice, values of 1000 poises are usually found. H. C. E.

240. Predict heat capacities of gases. W. R. Gambill. *Chem. Engng*, 1957, **64** (9), 267–70.—A general method of estimation based upon bond frequencies of vibration is presented, and is claimed accurate to within ±4% for all gases in the range 250°–1100° K. It can be extended to 1500° K, and a worked example is given. P. J. O.

241. Thermodynamic properties of pure and mixed hydrocarbons. Pt I. M. Hobson and J. H. Weber. *Petrol. Process.*, 1957, **12** (8), 45–7.—This article covers latent heats of vaporization for pure cpds and deals with the solution of the Clausius–Clapeyron equation from a minimum of data. One method depends upon the fact that the loci of saturated liq and vapour vol on P–V–T co-ordinates form a skewed curve that is quadratic in V. Others have proposed solutions based on generalized correlations between the difference in compressibility factor and the reduced variables. At reduced pressures higher than 0·4 the latter method is the more reliable and gives an average error of approx 3·5%. J. H.

ANALYSIS AND TESTING

242. Contribution to the analysis of German crude oil. (In German.) M. Luther and H. Jesse. *BrennstChemie*, 1957, **38** (1–2), 23–7.—Possibilities of spectroscopic methods in petroleum analysis are examined, and their present position is demonstrated. An investigation of the portions of some German crude oils of the Gifhorn anticline—origin, geological horizon, and analysis tabulated—not passing over up to 450° C (N.T.P.), by dist, chromatographic, and extractive separation is described. Chromatographic separations on Al_2O_3, also by Craig's countercurrent method, are described. Obtaining and evaluation of i.r. and u.v. spectra are discussed. 16 literature refs. R. T.

243. An integral detector for chromatographic analysis. (In German.) E. Leibnitz, H. Hrapia, and H. G. Könnecke. *BrennstChemie*, 1957, **38** (1–2), 14–16.—A brief review of the detectors used up to now in gas chromatography is presented. A new registering integral detector for chromatographic separation of mixtures—gaseous at atm temp and insol in KOH—is described and illustrated. The separating effect is a complex function of temp, column length and packing, and flow rate of the carrier gas, whose optimum val are determined empirically. The instrument is light and easy to operate. The chromatograms are evaluated easily. Reading accuracy is 1‰ referred to the amount of the gas mixture to be separated. 10 literature refs. R. T.

244. Gas chromatography. N. H. Ray. *Nature, Lond.*, 1957, **180**, 403–5.—This article gives a general outline of the methods used in gas chromatography, and indicates the types of problem for which it is most useful. H. C. E.

245. Photometric determination of vanadium and nickel in mineral residues of petroleum products. Z. Gregorowicz. *Nafta (Krakow)*, 1957, **13**, 39–41.—This paper is based on work by Lloyd, Wrightson, Hopps, and others, and also takes into account progress made by several Polish workers which has not yet been published. Vanadium gives permanent colour and Ni transient. Method is given and procedure, which yields results ±6·9% for vanadium and ±5·4% for nickel. The method has been compared with spectrographic analysis, which proves superior if the concn of V is below 0·5% and Ni below 0·05%. M. S.

246. Testing of bituminous binders in thin spread-out films. K. Letters. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (3), 83–92.—Investigation of behaviour and properties of complex bituminous binders—road tar and bitumen—by means of thin-spread films (0·3–2 μ thick) on H_2O. In preliminary experiments—a process of analysis—spreading behaviour on H_2O, dil soln of NaOH, HCl, $KMnO_4$, permeability for air bubbles, and shrinkage figures which form in the thin films on glass plates on water storage are observed. In a semiquant way cohesive forces, as breaking strength, are determined by loading with small lead shot, and from their magnitude as a function of the film thickness conclusions are drawn on the mol gradient, and therewith the plastic behaviour.

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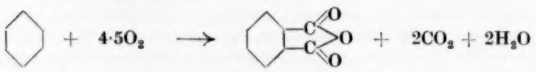

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230. Acetylene. P. W. Sherwood. *Petrol. Process.*, 1957, **12** (6), 89–93.—This describes the partial combustion of methane to produce acetylene. Gaseous oxygen is introduced with the feed CH_4 in the max ratio 0·65 : 1 to raise process temp to 1400°–1450° C by burning and to supply the heat required by the endothermic pyrolysis. The chief differences between the various commercial processes lie in details of burner design and recovery system. The 2 feed gases are separately preheated to 600° C, and thence pass to the ignition zone. Soot is removed during the quenching of the emergent gases and in a moving bed of coke. Following compression and aftercooling *ca* 99% of the C_2H_2 is recovered by absorption.
J. H.

231. Preparation of lubricating oil additives from dimercaptothiadiazole. E. K. Fields. *Industr. Engng Chem.*, 1957, **49** (9), 1361–4.—Lub oil additives prepared from dimercaptothiadiazole inhibit corrosion of copper–lead bearings, and are non-corrosive to, and prevent active sulphur corrosion of, silver bearings. Description of preparation of derivatives is given; also tables of yields, properties, and analysis of the derivatives. Test results for a typical member of each of 5 classes of derivatives are given. D. K. R.

232. Synthesis of hydrocarbons from carbon monoxide and steam. Communication III: synthesis on cobalt catalysts. (In German.) H. Kölbel and E. Vorwerk. *BrennstChemie*, 1957, **38** (1–2), 3–8.—Results are reported on the direct conversion of CO with steam on the Co–ThO_2–MgO–kieselguhr cat of the Fischer–Tropsch synthesis as model cat. Consideration is given—especially from a tech viewpoint—to the influence of operating conditions, temp, gas composition, and space velocity at normal pressure, in some cases in the medium pressure range up to 16 atm. By choosing suitable operating conditions the yield-reducing secondary reactions—conversion with H_2 formation, CH_4 formation, and CO decomp with C separation—are suppressed almost completely. Optimum ranges for the cat used are: temp 200°–240° C, CO–H_2O ratio 3 : 1–1 : 1, especially 1·5 : 1–2 : 1, space velocity for normal pressure 10–50, according to the other operating conditions, preferably so that CO conversion in a single passage = 70–80%. Basically, the synthesis from CO and steam with the same cat requires—compared with the Fischer–Tropsch synthesis—sharper reaction conditions. In spite of this, almost exclusively higher hydrocarbons are formed. CH_4 formation is very small, and can be obviated almost completely by using medium pressure. 27 literature refs.
R. T.

233. U.S. Patent No. 2,796,327. Anon. *Petrol. Process.*, 1957, **12** (8), 107.—Brief notes on a process which produces carbon black particles suspended in gas of H_2, CO, C_2H_2, and water vapour by complete combustion of a hydrocarbon in a free-oxygen containing gas. Ammonia is injected to react with the carbon monoxide to give hydrogen cyanide, some of which further combines with the acetylene to acrylonitrile.
J. H.

METERING AND CONTROL

234. Equations simplify fluid metering. E. R. Lynch and J. Schoenberg. *Chem. Engng*, 1957, **64** (8), 259–62.—The equations given enable the size and cost of the most efficient differential producer to be determined. They cover vol and mass flow of liq and gases, for orifice, Venturi, and other types of meter.
P. J. O.

235. How to meter highly volatile liquids. G. E. Batchelder. *Petrol. Process.*, 1957, **12** (8), 70–3.—Highly volatile liq vaporize readily on metering under slight increases in temp and reduction of pressure. This can occur through overheating, use of indirect and too small lines, restriction of flow in fittings, overheating, and unnecessary agitation. Procedure is listed to avoid these causes. Most systems use a vapour return line. If a differential valve is placed on this line, a back-pressure can be set up to avoid vapour carry-over from the receiver to the supply tank. J. H.

236. Calculate fluid flow by basic equations. L. M. Polentz. *Chem. Engng*, 1957, **64** (8), 282–6.—The author discusses the calculation of gas flow through pipeline orifices and nozzles, taking into account compressibility of the fluid. P. J. O.

PRODUCTS

CHEMISTRY AND PHYSICS

237. Equations of state. The application of orthoganol polynomials. C. J. Pings, Jr., and B. H. Sage. *Industr. Engng Chem.*, 1957, **49**, 1315–28.—An equation of state from which volumetric behaviour of pure hydrocarbons, in both liq and vapour phases, and enthalpy changes can be predicted was developed using open-ended series of orthogonal polynomials. The accuracy obtainable is comparable to that for the experimental data available, and an example is given in which the equation is applied to propane at pressures of up to 10,000 p.s.i. and temp between 40° and 460° F, and predicts behaviour with an average deviation from the experimental of only 0·27%. D. B. S.

238. Use of iron filings in a high viscosity medium for mapping approximate magnetic field shapes. J. B. Rechen and J. C. Jordan. *Rev. sci. Instrum.*, 1957, **28**, 584.—The use of a thin coating of high visc (65,000 cS) oil on a copper sheet, to which iron filings are then applied, enables the filings to align themselves slowly with the magnetic lines of force, and they are then not prone to fly to the magnet. Further, the pattern remains indefinitely after the magnet source has been removed. H. C. E.

239. Performance index for gas chromatographic columns. M. J. E. Golay. *Nature, Lond.*, 1957, **180**, 435.—Theoretical studies indicate that the performance index may be defined as

$$\frac{(\Delta t)^4 t' \Delta p}{t^3(t - 0{\cdot}75t')}$$

where Δt is the (time) width of the " band " at mid height, t and t' are the times after injection to centres of " air peak " and band respectively, and Δp is the pressure drop along the column. The formula has the dimensions of visc.

Theory indicates that the index of an ideal column should be of the order 0·1 poise; in practice, values of 1000 poises are usually found. H. C. E.

240. Predict heat capacities of gases. W. R. Gambill. *Chem. Engng*, 1957, **64** (9), 267–70.—A general method of estimation based upon bond frequencies of vibration is presented, and is claimed accurate to within ±4% for all gases in the range 250°–1100° K. It can be extended to 1500° K, and a worked example is given. P. J. O.

241. Thermodynamic properties of pure and mixed hydrocarbons. Pt I. M. Hobson and J. H. Weber. *Petrol. Process.*, 1957, **12** (8), 45–7.—This article covers latent heats of vaporization for pure cpds and deals with the solution of the Clausius–Clapeyron equation from a minimum of data. One method depends upon the fact that the loci of saturated liq and vapour vol on P–V–T co-ordinates form a skewed curve that is quadratic in V. Others have proposed solutions based on generalized correlations between the difference in compressibility factor and the reduced variables. At reduced pressures higher than 0·4 the latter method is the more reliable and gives an average error of approx 3·5%. J. H.

ANALYSIS AND TESTING

242. Contribution to the analysis of German crude oil. (In German.) M. Luther and H. Jesse. *BrennstChemie*, 1957, **38** (1–2), 23–7.—Possibilities of spectroscopic methods in petroleum analysis are examined, and their present position is demonstrated. An investigation of the portions of some German crude oils of the Gifhorn anticline—origin, geological horizon, and analysis tabulated—not passing over up to 450° C (N.T.P.), by dist, chromatographic, and extractive separation is described. Chromatographic separations on Al_2O_3, also by Craig's countercurrent method, are described. Obtaining and evaluation of i.r. and u.v. spectra are discussed. 16 literature refs. R. T.

243. An integral detector for chromatographic analysis. (In German.) E. Leibnitz, H. Hrapia, and H. G. Könnecke. *BrennstChemie*, 1957, **38** (1–2), 14–16.—A brief review of the detectors used up to now in gas chromatography is presented. A new registering integral detector for chromatographic separation of mixtures—gaseous at atm temp and insol in KOH—is described and illustrated. The separating effect is a complex function of temp, column length and packing, and flow rate of the carrier gas, whose optimum val are determined empirically. The instrument is light and easy to operate. The chromatograms are evaluated easily. Reading accuracy is 1‰ referred to the amount of the gas mixture to be separated. 10 literature refs. R. T.

244. Gas chromatography. N. H. Ray. *Nature, Lond.*, 1957, **180**, 403–5.—This article gives a general outline of the methods used in gas chromatography, and indicates the types of problem for which it is most useful. H. C. E.

245. Photometric determination of vanadium and nickel in mineral residues of petroleum products. Z. Gregorowicz. *Nafta (Krakow)*, 1957, **13**, 39–41.—This paper is based on work by Lloyd, Wrightson, Hopps, and others, and also takes into account progress made by several Polish workers which has not yet been published. Vanadium gives permanent colour and Ni transient. Method is given and procedure, which yields results ±6·9% for vanadium and ±5·4% for nickel. The method has been compared with spectrographic analysis, which proves superior if the concn of V is below 0·5% and Ni below 0·05%. M. S.

246. Testing of bituminous binders in thin spread-out films. K. Letters. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (3), 83–92.—Investigation of behaviour and properties of complex bituminous binders—road tar and bitumen—by means of thin-spread films (0·3–2 μ thick) on H_2O. In preliminary experiments—a process of analysis—spreading behaviour on H_2O, dil soln of NaOH, HCl, $KMnO_4$, permeability for air bubbles, and shrinkage figures which form in the thin films on glass plates on water storage are observed. In a semi-quant way cohesive forces, as breaking strength, are determined by loading with small lead shot, and from their magnitude as a function of the film thickness conclusions are drawn on the mol gradient, and therewith the plastic behaviour.

This results in 3 ways; through film thickness gradient in spreading; under use of sol of different concn and through expansion and compression of a single film. These mol gradients found with 6 bitumens B200 in 3 ways, giving consistent results, compare well with Krenkler's selective separation in 5 stages. Ageing investigations are discussed. The possibility is indicated, even with unfavourable conditions, of obtaining a conclusive picture of the properties, by combination of the single tests, especially the preliminary tests. Numerous illustrations and charts. 17 refs. R. T.

GAS

247. Boost flue gas temperatures with butane. H. W. Hill. *Chem. Engng*, 1957, **64** (9), 298–300.—A method of using butane to raise the temp of flue gas-heated equipment is described. P. J. O.

248. Commercial liquefaction of natural gas? P. B. Lederman and B. Williams. *Oil Gas J.*, 30.9.57, **55** (39), 97.—The technique of the liquefaction of natural gas at or near its source for transportation to other areas is fully reported on, the opinion being given that the technique is economically feasible and competitive with other sources of fuel, including atomic energy. G. A. C.

249. Process union begets low-cost ethylene. C. H. Chilton. *Chem. Engng*, 1957, **64** (8), 158.—The addition of hydrocarbon separation facilities to an existing standby oil gas plant makes feasible the production of very cheap C_2–C_6 hydrocarbons. The oil gas plant can thus be used all the year round to produce a marketable product, and not only as a standby. Cheap ethylene is thought to be potentially the most important product. P. J. O.

250. Lacq natural gas spells wealth for France. Anon. *Chem. Age*, 22.6.57, **77**, 1047.—Refined natural gas is now used in France's pipeline network. An output of 4 milliard cu. m. of gas is forecast. Sulphur and gasoline are already being yielded. A power station and chemical works are expected to be built at Lacq. R. T. T. B.

251. First Lacq unit has daily sulphur capacity of 200 tons. Anon. *Chem. Age*, 3.8.57, **78**, 181.—The H_2S present in Lacq natural gas is removed by cat oxidn to sulphur by air. An initial separation is made by D.E.A., and the S is removed in a tubular type condenser. R. T. T. B.

ENGINE FUELS

252. Limits of combustion intensity. J. J. Broeze. *Ingenieur, 's Grav.*, 14.6.57, **69** (24), O 49–5.—A comparison is made of the intensities attained in various technical combustion processes. The intensity in spark ignition engines is shown to be by far the largest, being of the order of 10^{11} k.cal/m³/h. Analysis of the process shows that the flame is propagated by the diffusion of heat and free radicals from the combustion zone. Mol diffusion is preceded by eddy diffusion, ensuring a much more rapid transport of active matter over great distances. The total combustion time is computed from the times required for eddy transport, for production of radicals, and for completion of the reaction. These time values are compared for different practical cases and for that of a bomb in which Longwell has studied intensity limits. 11 figs. G. F. T. C.

253. AK33X boosts octanes. Anon. *Chem. Engng News*, 15.7.57, 19–20.—Methyl *cyclo*pentadienyl manganese tricarbonyl, used in conjunction with T.E.L., permits higher antiknock values than can be obtained with T.E.L. alone. Its effectiveness depends on the base stock used, and its expense at present only justifies its use in aviation fuel for piston-engined aircraft. R. T. T. B.

254. Three grade marketing splits petroleum refiners. Anon. *Chem. Engng News*, 10.6.57, 14–18.—With high C.R. engines calling for high octane fuel, U.S. firms are marketing either 2 or 3 grades of gasoline or custom blending at the service station. The methods by which various U.S. companies cater for the diverse demand are considered from the point of view of refining and marketing. R. T. T. B.

255. Gas-turbine engines: at hand for automobiles? C. H. Chilton. *Chem. Engng*, 1957, **64** (8), 152.—Gas turbines may soon be ready for use in military vehicles and trucks, and later in private cars. P. J. O.

256. A look into the future for jets and jet fuel. W. S. Mount. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 29–33.—Aviation trends show a continuing demand for aviation gasoline, with relatively little falling off predicted up to 1965. Supplementing gasoline demand, there will also be a rapid build-up in commercial jet fuel and military jet fuel consumption, reaching a combined total in the free world of approx 1 million b.d. by 1965. Requirement for all present gasoline grades, plus several additional grades of jet fuel, may involve extra costs and complications in airport refuelling. This paper highlights some of the work accomplished by the API Aviation Technical Service Committee, and describes several problems which need urgent consideration. (Author's abstract.)

257. Jet fuel characteristics and the refuelling of jet and turboprop aircraft. J. S. Harris. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 34–7.—The airlines of the world are now placing orders for jet aircraft to be delivered in 1959, and are already operating aircraft powered by turbine engines driving propellers. This paper reviews briefly the differences between these engines and discusses the factors entering into choice of the fuels they will use and the handling problems connected with it. (Author's abstract.)

258. A stop and look at octane requirements. R. I. Potter. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 159–65.—Tests conducted in 1951 and 1955 on current model Ford cars with V-8 engines indicate that about 5 mechanical O.N. have been built into current production engines in the 4-year period. Tolerance for higher temp may be more important than extremely high O.N. for premium gasolines in the immediate future. It should be understood that whatever gasoline is made and marketed by the petroleum companies will be converted to h.p. by the automotive companies as efficiently as possible. (Author's abstract.)

259. Fuel quality requirements of high compression ratio engines. J. K. Appeldoorn. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 166–9.—The C.R. of cars will continue to increase over the next few years. To determine what effect this will have on gasoline quality requirements, studies were made in engines over a C.R. Several conclusions were reached: (1) Octane requirement increase (O.R.I.) will still be important. The O.R.I. may look small numerically (1 or 2 units), but in terms of increased knock intensity it will still be objectionable. Fuels can minimize O.R.I. if their heavy end fraction is eliminated. (2) Surface ignition will be more pronounced at high C.R. Some fuel additives can reduce surface ignition, but it is important that they do not simultaneously increase O.R.I. Unless an additive reduces the no-noise requirement, it serves no purpose in reducing surface ignition. (3) For a given C.R., one car make may have a consistently higher octane requirement than another. This difference is at least as great as the differences in O.R.I. found with various fuels and lubricants. One important reason for this difference is that cars differ in their " digestive ability "; one car will have a considerably greater O.R.I. than another. For this reason it is important, in comparing engine designs, operating variables, or fuel characteristics, to carry the test out to equilibrium. (Author's abstract.)

260. Segregating brands with hydrant refuelling. A. Keif. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 38–40.—Plans must now be made for ground refuelling facilities to handle the new medium of air transportation, the jet transport. The refuelling of jets differs in many ways from regular refuelling of aircraft. This paper discusses the problem and offers several pertinent facts to be considered when looking for a solution. Underwing or pressure refuelling will be employed, and good housekeeping will lessen the hazard of jet refuelling. Other more specific safety factors to be considered are listed. The author discusses the application of the hydrant system to the refuelling of jet aircraft. This system is a development of the fire-fighting facilities used in many cities. The purpose of the system is to ensure instantaneous and uninterrupted aviation fuel supply at the loading apron. The advantages and disadvantages of the system are presented. The type of system to be installed will depend upon the topography of the airfield and the regulations imposed by local airport authorities.

The Aviation Technical Service Committee has recommended brand segregation to the airlines. Specification alone is not a sufficient guarantee of quality. The committee has assumed the task of gathering data for the ultimate design of a prototype underground jet hydrant-refuelling system. Co-operation between airport operators, airlines, and aircraft manufacturers has aided the committee's efforts. Commercial aviation, if it is to grow and endure, must provide the best possible facilities for safe transportation.

(Author's abstract.)

GAS OIL AND FUEL OIL

261. Sediment formation in cat-cracked distillate fuel oils. R. D. Offenhauer, J. A. Brennan, and R. C. Miller. *Industr. Engng Chem.*, 1957, **49**, 1265–6.—Sediments formed in cat-cracked fuel oils were analysed and found to contain sulphonic acids formed by the oxidn of aromatic thiols and condensation products formed from pyrroles. The mechanism of the reaction by which insoluble sediments can be formed from these is discussed. 1-Naphthol was found to form sediments independently. Removal of aromatic thiols and 1-naphthol by caustic soda treatment lowered sediment formation in the fuels studied. D. B. S.

262. Acidic components of catalytically cracked distillate fuel oil. A. L. Williams and R. D. Offenhauer. *Industr. Engng Chem.*, 1957, **49**, 1259–64.—Aromatic thiols were separated from phenols in 2 cat-cracked dist fuel oils and the following detected: alkyl and polyalkyl benzenethiols, naphthalenethiols, and biphenylthiols. Phenols present included 1- and 2-naphthol, *p*-phenylphenol, polyalkylphenols, indanol, methylindanols, and/or tetrahydronaphthols. Phenol and polyhydroxybenzenes were not found. Aromatic thiols were found to promote sediment formation, but of the phenols present only 1-naphthol was active in the development of colour and sediment. D. B. S.

263. Heating oils have improved in quality. W. A. Sullivan, Jr. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 112–16.—Contrary to early predictions, the increased use of cat cracked dist in heating oils has not seriously impaired heating oil quality nor reduced the popularity of oil heat over the past 10 years. Improved burner designs as well as the development of more effective fuel-refining techniques have been contributing factors in offsetting disadvantages which were expected to result from the use of cracked components. Lack of storage stability of cat cracked blends has been the most difficult problem to overcome. Results of semi-annual surveys conducted over the past 5 years in 14 major heating-oil markets throughout the country indicate that a marked improvement in heating oil stability has resulted from the increased use of additives and more effective refinery treatment made possible by research, which has led to a better understanding of the problem. Still greater improvements in heating oil quality are foreseen as a result of the increasing use of hydrogen for cat desulphurization and stabilization of dist fuels.

(Author's abstract.)

264. The 10-year economic improvement in heating oils. W. Butler. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 117–21.—Until comparatively recently, refiners and large marketers regarded middle dist as an unprofitable nuisance. Therefore, they had little real interest in the product. The growing number of oil-heated homes and diesel engines gradually made refiners and large marketers aware of the product and of their responsibility to meet both quantity demand and quality requirements. However, it has been only in the past few years that middle dist have gained respect because of the volume they account for and the profits they yield. For one thing, the demand for middle dist has been growing much faster percentagewise than the demand for gasoline. Also, thanks to cat processes, much of the increased middle dist output comes from portions of the brl formerly sold as residual oil. Residual oil consistently sells for less than crude oil at the wellhead, while middle dist sells for substantially more. In 1955 residual oil sold at the Gulf Coast for 75 c/brl less than crude oil, while No. 2 heating oil sold for 84 c more. Altogether, when a refinery was able to elevate portions of residual oil to No. 2 heating oil, the refiner was able to get $1.59/brl more for it. Refinery spreads being what they are, this could mean the difference between a profit and loss for a refiner.

(Author's abstract.)

265. Ohio's experience in competing with natural gas. R. H. Collacott. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 122–5.—In Ohio, marketing of domestic heating oils was preceded by a fairly extensive natural gas service, and what progress has been made in enlarging the oil market furnishes a fine example of co-existence. Fuel oil distribution is conducted almost entirely by gasoline marketers. Although both coal and natural gas exceed fuel oil by a wide margin in the total number of home heating installations in Ohio, the record of the past 5 years shows a 119% increase for oil heat as compared with a 58% increase for gas.

Oil heat has the advantage of universal distribution; gas, where available, still has the advantage of price. Of the homes serviced with gas, many do not use gas for heating. These, together with the homes which still use coal for heating, offer the largest area for expansion. (Author's abstract.)

LUBRICANTS

266. Effect of inertia on wide angle flow in hydrodynamic lubrication. J. F. Osterle and W. F. Hughes. *Engineer, Lond.*, 1957, **204**, 449.—In theories of hydrodynamic lubrication propounded by Lewicki (*cf.* Abs. **744**, 1956) and Milne, the contribution of lubricant inertia is neglected. It is suggested that for flows in which the slider inclination is large (*i.e.* > several degrees) the neglect of lubricant inertia can be a serious error. Article studies the matter qualitatively and quantitatively. (Authors' abstract.)

267. Versatile gelling agent. Anon. *Chem. Engng News*, 29.7.57, 52–3.—A new synthetic gelling agent Oronite GA 10 (methyl N-*n*-octadecylterephthalamate) in the form of its sodium salt gives greases highly resistant to radiation, heat, and water. R. T. T. B.

268. Hydrogen, clay vie in lube oil race. Anon. *Chem. Engng*, 1957, **64** (8), 146.—Output of hydrogen-treated lub oil is expected to soar 233% in 1957, but a new continuous percolation process may soon be in use in the competition to improve lubricants. P. J. O.

269. Investigations on artificial and natural ageing of unalloyed mineral lubricating oils. (In German.) S. Spengler and H. O. Hössl. *Erdöl u. Kohle*, 1956, **9**, 686–90.—Chemical changes of mineral lubricants in artificial ageing in the lab under different conditions and pre-treatments, and in natural ageing in the motor, are reported, and connexions detected. Ageing products—consisting chiefly of naphthenes and of aromatics—exert an inhibiting effect on resin formation. Effects of resins and hard asphalts are defined. Regenerated oils give better ageing than fresh oils. Ageing stability deteriorates with total aromatic separation. The final effect of the constitutional changes in the oil is increase in naphthenes and decrease in aromatics and paraffins. A relationship between C distribution and ageing stability of various oils is not confirmed. Ageing val of naturally aged oils in 3 motor vehicles, on test stretches of *ca* 1500 km, do not differ essentially. Details of the results for ageing tests in motor vehicles, carried out under the given travel conditions, are given. R. T.

270. Investigations on the film resistance of lubricating oils in the slide bearing in dependence on loading and rev/min. Pt 2. Experimental operation and error evaluation. (In German.) E. Terres, G. Morlock, and K. H. Völker. *Erdöl u. Kohle*, 1956, **9**, 690–3.—Preliminary checks described ensure satisfactory measuring methods whereby disturbing influences—which may falsify the results—can be removed. Tests and instrumentation are described in which film strength is measured by the No. of revolutions in which the oil film is broken through to give contact between the metallic surfaces. Measurements are reported at pressures of 3000, 2000, 1500, 1000, and 500 kg on the bearing. Roughness and dia of the shaft and bearing are measured before and after the tests. Basic oils of the same origin show an increase in abs lubricating effect with increase in visc. E. Falz's general hydrodynamic theory does not explain lub behaviour; G. Vogelpohl's derived formula—allowing for visc changes in the oil—gives a satisfactory explanation. R. T.

271. Cold behaviour of motor oils. (In German.) T. Hammerich and A. Schmitz. *BrennstChemie*, 1957, **38** (1–2), 9–14.—Cold behaviour of motor oils—conventionally determined by extrap of visc curves—is discussed. A modified Hoppler viscometer (viscowaage) which permits measurements in the range 0·01–10^6 cP, and a rotation viscometer (rotavisco) measuring in the range of $4 - 2 \times 10^6$ cP with an accuracy of 2% are used. Visc–temp curves of the oils investigated deviate at low temp from the visc–temp function which applies to Newtonian liq only. They are steeper, with an upward concave tendency. Foreman's experiments with the Stormer viscometer produced similar results. Curves obtained with the rotation viscometer approach the extrapol straight line more closely than those obtained with the viscowaage. In the set. pt. region the cold visc tends clearly towards the unfavourable side. A comparison is tabulated of starting limits determined by extrapol or direct measurements. The typical many-purpose oils containing V.I. improvers—in addition to conventional antioxidants, set. pt. improvers, and detergents—behave mutually somewhat variably. Single-purpose oils generally guarantee startability. 8 literature refs. R. T.

272. Lubricant specifications. 7(b). Temporary protectives and rust inhibitors. E. G. Ellis. *Sci. Lubric.*, 1957, **9** (3), 27–35.—Min. of Supply Specs C.S. 1033E (Composition Rust Preventive), C.S. 2485A (Mineral Jelly, High Melting Point), C.S. 1969B (Petrolatum, Soft), C.S. 1663b (Composition Preservatives, Spraying), C.S. 2298C (Preservative for Metal Components Containing Rubber), and C.S. 2060C (Preservative PX-10—Water Displacing Fluid) are set out and discussed in detail. J. G. H.

273. Some notes on the lubrication of agricultural tractors. 3. Hydraulic systems. A. C. Smith. *Sci. Lubric.*, 1957, **9** (1), 16–24.—Rear-mounting systems using oil-driven hydraulic transmission are in predominant use for the attachment of implements and driven machinery to agricultural tractors. Details are presented of the David Brown three-point hitch, their single acting gravity return system, and of the Ferguson hydraulic system. Mechanical and hydraulic circuits, together with lubricating circuits, are illustrated. J. G. H.

274. Oil cooling and oil coolers. 2. Oil coolers in general. G. A. Montgomerie. *Sci. Lubric.*, 1957, **9** (4), 16–21.—Typical water-cooled circuits are described and illustrated, and thermostatic controls are explained. Special arrangements for tubular oil coolers are discussed, together with secondary heat exchangers. J. G. H.

275. Why better lubricants? C. M. Heinen. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 149–58.—Some of the influences which are affecting engine design are evaluated, including public interest in higher output engines, consumer demand for power assists, styling, increased concentration of vehicles, improved roads, and increasing operation in cold climates. These trends result in 4 requirements for all lubricants: (1) greater fluidity at low temp; (2) increased resistance to heat; (3) greater load-carrying ability; (4) compatibility with more and more materials. The effect of requirements on transmission and power steering fluids, rear axle fluids, and brake fluids is discussed in detail. (Author's abstract.)

276. Properties and industrial use as lubricant of pure molybdenum disulphide. (In German.) F. Kuhn Weiss. *Ingenieur, 's Grav.*, 19.4.57, **69** (16), W 55–65.—After explaining the principles of hydrodynamic and boundary lubrication by means of diagrams, the author gives a detailed account of the physical and chemical properties of MoS_2, with special emphasis on crystal structure and particle size of commercial products. MoS_2, unlike graphite, is chemically bonded to the bearing metal. The compressive strength of such a film is of the order of 7000 kg/sq. cm. and exceeds the flow limits of most metals. Practical experience with MoS_2 lubrication has been gained in the Bundesbahn works at Augsburg. Results are given in graphical representation, and different methods for applying a dry lubricant film during the manufacturing process are described. The author discusses further the incorporation of MoS_2 in lub oils, E.P. lubricants, greases, and in a formulation of synthetic resins for bearing manufacture. 23 figs. G. F. T. C.

277. Molybdenum disulphide engine lubricant. Anon. *Engineer, Lond.*, 1957, **204**, 355.—A new additive for engine oils ("Molyspeed"), containing a much smaller particle size of molybdenum disulphide than prevails in industrial lubricants, has been evolved by Rocol Ltd, Leeds. Tests on 412-cc J.A.P. air-cooled petrol engines showed 16–18% increase in power at full speed (2200 rev/min) and reduced fuel consumption. Less stoppages due to exhaust valve sticking were encountered. 75% of the MoS_2 is deposited on the exposed metallic surfaces, and deposit lasts as long as charge of oil, hence inclusion (6% vol) of "Molyspeed" is necessary only at alternate oil changes. A. C.

278. Some problems associated with the recommendation and use of multi-viscosity oils. L. Withrow. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 170–9.—The paper describes some reactions of a group of automobile engineers to the advertised qualities as distinguished from the actual performance of multi-visc oils in automobiles. It is emphasized that, in controlling combustion chamber deposits, these oils may be worth several dollars p.a. to the automobile driver. Evidence is presented showing that some multi-visc oils are non-Newtonian fluids

at low temp; accordingly, it is fallacious to determine their visc temp characteristics by the present extrapolation procedure. It is equally fallacious to advertise the performance of multi-visc oils on the basis of extrapolated visc data. Finally, a plea is made for realistic advertising.

(Author's abstract.)

BITUMEN, ASPHALT, AND TAR

279. Preparation of asphaltic bitumen from an Edeleanu extract. M. Krajcinovic, B. Prohaska, D. Zutic, and Z. Krckar. *Nafta (Yugoslavia)*, 1957, **8** (7), 203–6.—This study deals with the preparation of asphaltic bitumen from Edeleanu extract, as a by-product in solvent refining of lub oil. It has been established that the most convenient method is first to remove the non-reacting part from the Edeleanu extract by dist. In a series of tests the conditions under which the air blowing of dist residue has to take place have been ascertained.

(Authors' abstract.)

280. Mineral fillers in roofing composition industry. H. Walther. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (3), 98–102.—The effect of mineral fillers on roofing compositions is discussed and supported by mechanical tests. Consideration of the data indicates very clearly the essential influence of particle form of mineral powders, and emphasizes the necessity of a studied choice, as made possible with the relatively simple methods of investigation presented. R. T.

281. 100 years of roofing paper. History and salient points. Anon. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (4), 135–8.—The history of roofing paper—tar and bitumen—development in 100 years is presented. Production methods and applications to sealing of flat roofs with refs to sp work and authors are discussed. R. T.

282. Noteworthy viewpoints on failure avoidance in bituminous covering construction. R. Wilhelmi. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (4), 125–7.—Points—often ignored—which cause failures or rejections are discussed. Important factors are binders (visc), grain form of chips, mixed material, covering structure, and laying. R. T.

283. Bitumen emulsions—recent advances in knowledge of their properties. (In German.) H. Nüssel and A. Buhs. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (11), 423–27.—Pt I. Low interfacial tension, which favours emulsion preparation with high bitumen cont, depends on the presence of active substances at the oil/H_2O interface. Org mol—setting up a lyophilic group and an oleophilic long-chain org rest—are effective. For easy emulsification the presence of natural emulsifiers, *e.g.* high-mol naphthenic acid—present in bitumen and detected by its NZ (neutralization No.)—is essential. High-NZ bitumens can be emulsified with pure alkalis, producing a soap *in situ* with naphthenic acid. The NZ can be taken as a criterion for suitability of a bitumen for emulsification. Curves—average particle radius in emulsifying in weak alkali V alkali concn in the aq-phase—are parabolic. The optimum dispersion degree is at 0·6–0·8 μ particle size. From the curves it is seen that the smallest average particle radius as a measure of emulsifiability decreases with the bitumen NZ, therefore, with the No. of polar mol in the bitumen. The No. of these mol is decisive for the dispersion degree, on which the sp surface of the dispersed bitumen depends. Factors influencing visc, which is affected considerably by the aq-phase composition, and variable formation of the hydrate envelope conditioned thereby, are discussed. 17 refs. R. T.

284. Viscosity measurement on bituminous binders. F. Schulz. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (5), 183–9.—Visc of bituminous binders, according to consistency, are measured at different temp in the conventional road tar viscometer. By simple conversion the visc are placed on a comparative basis. This produces either a similar ref temp, and thereby a scale of different visc in STV-sec, or a similar ref visc, and thereby a scale of different EVT-temp. Conversion possibility can also simplify visc measurement in that, according to consistency, the most favourable measuring temp can be taken. Conversion is only possible under definite assumptions. These must be proved sufficiently accurate for the proposed conversion. First, an exact investigation of the relationship between theory and practice respecting visc–temp-dependence can clarify whether conversion of visc between 2 temp secures useful results. R. T.

285. Tube asphalt on rubber-bitumen basis. H. A. W. Nijveld and H. A. O. W. Geesink. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (5), 182.—Continuation of article, this journal, 1954, **5**, 31. New recipe presented for product with improved mechanical properties. R. T.

286. Gilsonite yields coke plus gasoline. Anon. *Chem. Engng News*, 12.8.57, 28–9.—American Gilsonite opened a $13 million refinery to convert solid hydrocarbon, gilsonite, to coke and gasoline. The hydrocarbon is mined hydraulically and transported by pipeline as a water slurry. It is refined by conventional methods. Proven resources are equivalent to 100 million brl of crude oil. Si content is low, and 4% N suggests a source of NH_3. R. T. T. B.

287. Investigations on weathering of bitumen. R. Dubrisay. *Chim. et Industr.*, 1957, **78**, 103–6.—Thin bitumen films (obtained by evap of toluene soln in a Petri dish) weathered in air (up to 5 yr at ambient temp, 24 weeks at 100° C) and exposed to light (artificial and sunlight, up to 200 hr). Extent of weathering assessed by toluene insolubles and by emulsifying test based on IFT and indicating presence of acidic bodies. Weathering is oxypolymerization phenomenon, accelerated by light (especially that of shorter λ) and retarded by addition (¼%) of hydroquinone, aniline, or other antioxidants. V. B.

288. Durability of asphalt—its ageing in the dark. W. P. van Oort. *Industr. Engng Chem.*, 1956, **48**, 1196–201.—The amounts of oxygen absorbed by thin films of asphalt at temp between 20° and 70° C were measured, and adsorption–time and visc–time curves drawn. The data were expressed mathematically, and a theoretical curve having the diffusion coeff of oxygen in asphalt and the reaction coeff of oxygen with asphalt as parameters was found to agree well with the experimental curve. D. B. S.

289. Factors in preparing bentonite-stabilized asphalt emulsions. W. A. Higgins and T. J. Walsh. *Industr. Engng Chem.*, 1957, **49**, 1267–70.—The effectiveness of emulsification was studied in a turbo-emulsifier, and relationships between the energy required per lb of asphalt and the average particle vol or developed internal surface area obtained. Acid treatment of the bentonite slurry was found to improve the emulsification characteristics, and in addition better results were obtained when the slurry temp exceeded the soft. pt. or m.p. of the asphalt. D. B. S.

290. Oxidation of road tar. H. Mallison and K. K. Hofmann. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (5), 171–2.—The simple lab oxidn process described is proved suitable for testing the comparative tendency of different road tars to oxidn. Closer insight into the course of oxidn is obtained, although lab and road temp conditions affect the oxidn rate. R. T.

291. Structure of mixtures of coal tar and bitumen. (In German.) K. Berneis and L. J. Wood. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (11), 419–21.—Experiments are reported on mixtures—in numerous wt ratios—of prepared tar

with 2 dist bitumens from crude oils of different origin. Bitumen I gave homogeneous mixtures in all ratios; bitumen II showed a miscibility gap in the middle range. Soft. pt. curves of the mixtures as a function of composition showed a strong deviation from the linear—contrary to the ideal mixture law—with excess bitumen. In the same mixture range marked anomalies were established regarding the benzene-insol—Mallison's method H- + M-resins—cont of the mixtures, in that these lay considerably below the val calc on the basis of tar component cont in the benzene—insol constituents. Theoretical implications of the results are discussed. 11 refs. R. T.

292. Stabilization of road pitch with post-extractive asphalt. L. Kossowicz. *Nafta (Krakow)*, 1957, **13**, 21–3.—During the past 30 years it has been observed that roads made with coal tar stabilized with bituminous asphalt last nearly 3 times as long as those not so treated. Although the proportion of asphalt can be as high as 35%, it generally is *ca* 20%. None of the paraffin base residues and few of the naphthenic base residues are at all suitable. Albanian crude yields suitable residues. Aromatic rings are, according to the investigation made by Coal Chemistry Institute, necessary for success, so in search for the right kind of material, post-extractive asphalt has been tried. Rosins found in them contain S and O and exercise emulsifying action. Paraffin-base extractive residues have improved surface-active properties if they are blown at *ca* 260° C. Such products are then superior to Albanian asphalts, and they need not be cut back. After successful lab experiments there will be some road tests done in the immediate future. M. S.

SPECIAL HYDROCARBON PRODUCTS

293. Manufacture of white oils. I. Zamberlin and S. Kocet. *Nafta (Yugoslavia)*, 1957, **8** (6), 165–70.—The significance of white oil manufacture for the Yugoslav economy is discussed, and lab and pilot-plant experiments are reported. A selectivity refined and dewaxed dist from an Iraq crude oil, and a spindle oil dist from a domestic crude oil from Kriz were used. The white oils obtained by both procedures and both raw materials had properties which generally complied with the requirements of the Yugoslav Pharmacopeia.
(Authors' abstract.)

DERIVED CHEMICAL PRODUCTS

294. Ethylene oxide by the direct oxidation process. 1. P. W. Sherwood. *Oil Gas J.*, 30.9.57, **55** (39), 80.—Growth of the process, which uses 30% of entire ethylene output is summarized. Production of ethylene oxide in 1955 was 910 million lb, and it is estimated that by 1960 output will be 1250 million lb. A flow sheet is given. G. A. C.

295. Synthetic fuels and chemicals. Various. *Industr. Engng Chem.*, 1956, **48**, 1110–51.—Future trends in engine design (gasoline, diesel, gas turbine, free piston) and fuel requirements are discussed, and the 6 papers show how better synthetic fuels and chemicals may be obtained from available natural resources. Subjects include problems associated with the oxygen gasification of coal; the manufacture of synthesis gas by partial oxidn; the purification of synthesis gas; the constitution of organic acids prepared from Colorado oil shale; a method for refining oil shale; and hydrofining thermally cracked shale-oil naphthas. D. B. S.

296. Oil polymer masterbatching. W. K. Taft *et al.* *Industr. Engng Chem.*, 1956, **48**, 1220–8.—It is shown that the amount of polymer breakdown during ageing in the presence of aromatic oils is not controllable, although the rate of breakdown can be controlled by varying the iron content in the polymerization charge. The u.v. absorbencies of 10 oils used were found to obey Beer's law when plotted against their concn in soln with *n*-heptane or an 85%/15% methyl *cyclo*hexane/ethanol mixture. The effect of the aromaticity of the oil on the breakdown is discussed. D. B. S.

297. Carbon black in the oxidation of butadiene–styrene vulcanizates. J. R. Shelton and W. T. Wickham, Jr. *Industr. Engng Chem.*, 1957, **49**, 1277–82.—The presence of carbon black normally accelerated the rate of oxygen absorption, but low loadings of the black decreased the rate in certain cold rubber vulcanizates. The presence of iron (which itself normally increases the rate of oxygen absorption) was found to decrease the accelerating effect of the carbon black and vice versa, and consequently the net effect depends on the relative magnitudes of the individual effects in the vulcanizate in question. Mechanisms by which the oxidn occurs are suggested. D. B. S.

298. Oil masterbatched butadiene–styrene polymers. Influence of various anti-oxidants on polymer breakdown. W. K. Taft, J. Duke, and D. Prem. *Industr. Engng Chem.*, 1957, **49**, 1293–6.—The effects of 8 anti-oxidants, of both staining and non-staining types, on the heat-breakdown characteristics and stability of oil–polymer master batches were investigated. The non-staining anti-oxidants β-conidendrol and " 2246 " were found to be the most superior from the point of view of ultimate polymer stability. The differences between the anti-oxidants were found to be more apparent with base polymers, but to diminish as the aromaticity of the oil used increased. D. B. S.

299. Influence of petroleum oils on staining and discoloration of elastomeric compounds. H. M. Tramutt *et al.* *Industr. Engng Chem.*, 1957, **49**, 1283–92.—This preliminary work was carried out in order to classify petroleum oils according to the influence of their composition on the staining and discoloration of elastomeric cpds. The development of a quantitative blue-light reflectance method to measure the effects is also described. D. B. S.

300. Three new plants will be first to use Shell ethylene oxide process. Anon. *Chem. Age*, 18.5.57, **77**, 836.—3 ethylene oxide plants are to be built which involve reaction of ethylene with oxygen rather than air. A silver cat is used. One plant is to be built in the U.K. and the other 2 abroad.
R. T. T. B.

301. Calspray extend French petrochemical works. Anon. *Chem. Age*, 27.7.57, **78**, 141.—A plant to produce 12 metric tons/day of Captan (N-trichloromethylthiotetrahydrophthalimide) insecticide and various other products from butadiene has been built at Port-de-Bouc in France. R. T. T. B.

302. Union Carbide plan £3 million Fawley unit for ethylene oxide derivatives. Anon. *Chem. Age*, 24.8.57, **78**, 288.—A plant to convert ethylene to ethylene oxide and other glycols, ethers, and specialized products is scheduled to be operative in 1959. R. T. T. B.

303. Canadian expansion in chemicals and petrochemicals. Anon. *Chem. Age*, 11.5.57, **77**, 808.—The expansion of the Canadian chemical and petroleum chemical industry is considered in some detail. The petroleum chemical industry is now moving from a dependence on waste gas from oil refineries to operations closely integrated with actual refining processes.
R. T. T. B.

304. The influence of synthetic detergents on sewage purification. P. N. Degens *et al.* *Ingenieur, 's Grav.*, 26.4.57, **69** (17), G7–0.—The view that all syndets have an adverse effect on the various stages of the sewage purification process is not generally correct. The primary sludge settling is not

affected by the active part of the detergent but possibly by the "builders." Excessive foaming in the aeration tanks can be controlled by water sprays or foam inhibitors. Methane fermentation is not affected, provided the phosphate content is kept low. The biological purification of the presettled sewage is not influenced by those syndets that are themselves decomposed by the bacteria. Syndets with highly branched C-chains tend to inhibit the biological decomposition of the organic material. This may be corrected by introducing more oxygen, *i.e.* more vigorous mixing and longer aeration. 1 fig, 57 refs. G. F. T. C.

305. Petrochemistry, a new field of Rumanian chemical industry. C. Robu. *Chim. et Industr.*, 1957, **78**, 285–7.—Current (1956–60) 5-year plan provides for a 50,000-tons/year synthetic rubber plant using cracking gas, while the second 5-year period calls for a 15,000-tons/year PVC unit employing C_2H_2 obtained by electric cracking of natural gas. Synthetic fibre and solvent plants are also planned. V. B.

COAL, SHALE, AND PEAT

306. Low-temperature carbonization under mechanical pressure. (In German.) H. Schmidt. *BrennstChemie*, 1957, **38** (1–2), 19–23.—The lab apparatus—illustrated and described—enables the behaviour of solid materials to be observed—with quant estimation of reaction products—under optionally high mechanical pressure. The chief object is a lumpy, solid coke. With this apparatus, fuels—lignite, peat, wood, etc.—which show no tendency to coking under conventional low-temp-carbonization—become plastic, yielding lumpy coke of considerable strength under sufficiently high mechanical pressure. The quantity of individual products resulting from the heat-treatment of the different materials is not influenced by pressure. Coke strength is not attained at the expense of the tar yield. Advantages over the conventional analysis in the Fischer aluminium retort are discussed. Since pressure influences only the nature of the coke, the process is justified in that it reveals the tendency of the coal to form a solid coke. On the basis of the carbonization results a continuous semi-tech installation has been developed for producing lumpy coke from non-caking coals in which the material first reaches the pressure stage after extensive preliminary low-temp-carbonization. R. T.

307. Shale oil: headed for the big time? C. H. Chilton. *Chem. Engng*, 1957, **64** (9), 146–8.—The economic reasons for building Union Oil's new 300 ton/day retort in Colorado, and the constructional details of it, are briefly discussed. The unit needs no cooling water; it uses countercurrent flow of shale and combustion gases, discharging both at near ambient temp, and is expected to make substantial economies in shale oil production possible. P. J. O.

308. Phenols of condensable low-temperature-carbonization products of peat. (In German.) H. Steinbrecher and D. Schleede. *BrennstChemie*, 1957, **38** (1–2), 16–18.—The composition of the crude phenol mixture extracted from tech low-temp-carbonization liq from peat is investigated. Vac dist precedes dist into 73 narrow fractions and their identification by partition and paper chromatography. The 28 phenols boiling up to 288° C are tabulated as identified chemically and by u.v. exposures. Tabulated comparison shows the residue—not distillable from 288° C without decomp—of the crude phenol mixture from peat low-temp-carbonization liq as fivefold that from coal; lignite holds an intermediate position. R. T.

CORROSION

309. Cathodic protection of underground refinery equipment. P. W. Sherwood. *Corrosion Tech*, 1957, **4**, 313–17.—Cathodic protection of underground pipelines—which readily undergo pitting—is applied alone or in conjunction with other protective measures. The theory of cathodic protection, methods of introducing an impressed potential, and local conditions to be observed, are described. In refinery installations galvanic anodes can be applied, but a stronger current, when necessary, may be supplied from a d.c. source, *e.g.* from the installation itself. In both cases an anode must be provided in the soil. Galvanic anodes are more suitable for coated pipes; they can be arranged regularly along the pipes if the variable nature of the soil permits it. Mg is the best material under conditions of high corrosion potential and high soil resistance. Comparison is made with Al and Zn. Estimation of cathodic requirements from data—obtained with available instruments—on details of the installation and the surrounding soil is discussed. Interference by stray currents from other metallic structures must be considered. Anode location and design are discussed. A cathodic protection system must be justified on its merits. R. T.

310. How repair and double diffusion treatment saved a cooling tower. L. L. Crowl. *Petrol. Process.*, 1957, **12** (4), 86–9.—Fungi attack on redwood timbers in a water-cooling tower was halted by ppt of cupric chromate. J. H.

311. Cathodic protection of iron against corrosion by galvanic cells; possibilities of increasing its efficiency by weakening the aggressiveness of soil. T. Markovic. *Nafta* (*Yugoslavia*), 1957, **8** (5), 147–50.—On the basis of former researches on the rate of metal corrosion in soil, the influence of the water-to-air ratio in soil on the cathodic protection of iron in soil has been tested on a lab scale by the galvanic method. The water-to-air ratio in soil has been taken as the starting point in explaining the electrochemical processes in the cell Fe–(soil + water)–less precious metal. At the same time the water-to-air ratio was used for the kinetic process, showing the progress of corrosion of the cathodically protected iron and the anodic material (Zn and Mg). In this way the protection in soil which was not water-saturated was 10 times less effective than in a water-saturated soil. The aggressiveness of soil can be reduced by saturating the soil with water, and thus the effectiveness of the cathodic protection increases. This observation has been used for calculating the cathodic protection of pipelines in soils in which the aggressiveness has been reduced. The tin-coated iron pipe which serves for water supply and for the flooding of the adjacent ground was being used as anode. The calculations have shown that *ca* one ton of water is necessary for a 1-km pipeline. The tin coating of 5 mm thickness on the 1-inch iron pipe is sufficient for effective cathodic protection during 30 years in a water-saturated soil. (Author's abstract.)

312. The qualities of a good pipe coating. L. F. Bramble. *Pipe Line News*, 1957, **29** (9), 63–70.—The qualities of an asphalt pipe coating are described from the point of view of the various deteriorative influences to which the pipeline is subject. These are given under the headings: electrical resistivity, moisture resistance, heat stability, soil stress resistance, all temp performance, flexibility and ductility, and primer efficiency. D. K. R.

313. U.S. tankers freed from corrosion. J. Grindrod. *Corrosion Tech*, 1957, **4** (8), 278–80.—Successful application of cathodic protection to 2 steel ships—the 12,500-ton *Marine*

Chemist and the 18,000-ton *Marine Dow-Chem*—is described. 2 groups, each consisting of 53 60-lb Mg anodes—located just aft of the port and starboard bilge keels of the chemical carrier *Marine Chemist*—gave restricted protection, *ca* 80% of the underwater area after 2 years' experience. The unprotected 20% was confined mainly to the hull and stern. A more distributed anode system of 6 groups of 20 60-lb anodes, to extend the area, was effective excepting for the bow. 2 groups of 10 60-lb anodes installed as near to the bow as practicable proved effective. To protect the vessel in 1956 operational year, 136 44-lb coated anodes—with a new shape and core arrangement, and tough, plastic coating which could be cut away to expose controlled amounts of surface—were welded to the hull in the same general pattern. The *Marine Dow-Chem* was protected successfully with 180 60-lb Mg anodes. The chem tanks and pipes have been specially lined. Tables show savings attributable to cathode protection as worked out by the Dow Chemical Co. R. T.

SAFETY PRECAUTIONS

314. Extinguishing hydrocarbon and transformer fires by oil agitation by a compressed gas. L. Cabanes, G. Dubois, and J. Baclet. *Rev. Gen. Elect.*, 1957, **66**, 395–403.—Risk of transformer fires is very slight (statistics given) and does not warrant heavy capital expenditure on fixed fire-fighting equipment, particularly in view of flexibility available to a nationalized undertaking. Gas agitation fire extinguishing procedure developed by Socony Mobil is explained, with table of gas flows required for tanks of various sizes (max requirement 30 litres/m²/min). Nature of transformer fires is discussed. Tests were made on transformers (up to 20,000 kVA containing 20 tons oil) which had combustion periods of up to 2 hr; N_2 agitation is a successful means of extinguishing, provided that a draw-off valve is fitted 10 cm below normal oil level, through which oil can be withdrawn if fire starts, to provide ullage and prevent overflow on agitation. Aspects of transformer design which could minimize fire risk are considered. V. B.

MISCELLANEOUS

315. The riches of Kuwait. Anon. *Petrol. Press Serv.*, 1957, **24**, 323–5.—To the massive reserves of Burgan—one of the largest fields in the world—and the smaller resources of Magwa-Ahmadi, 2 or 3 new fields in the N. must be added. At the Mena al-Ahmadi port a second pier in deeper water is planned. This—the North Pier—being located 4 miles N. of the present one—will accommodate tankers up to 100,000 tons. The new facilities will allow average loading rates of 5000 tons/hr with a max rate of 6750 tons/hr. 3 tankers of the largest size will be accommodated simultaneously at the berths in the first instance, the pier-head 5700 ft from shore being in 55–60 ft of water. Construction—beginning this month—will be complete in *ca* 2 years at a cost of approx $8 million. Present loading capacity is being extended to *ca* 1·5 million b.d. In addition, facilities will provide for loading fuel oils as bunkers to tankers, or as cargoes. A ninth 32-inch gravity line is being constructed from the main crude oil tank farm at Ahmadi to the loading termini, and 4 submarine pipelines connecting the 2 new sea berths have been launched. Expansion of Kuwait Oil Co's refinery from a capacity of 1·4 million to 8·5 million tons p.a., begun in 1956, is expected to be complete by early 1958. Present production rate in Kuwait is >60 million tons/yr, and the capacity of oil-handling facilities is being extended beyond 75 million tons/yr. As Kuwait develops the local oil industry becomes increasingly integrated into the community. R. T.

316. The Italian scene: ENI'S expanding empire. Anon. *Petrol. Press Serv.*, 1957, **24**, 330–4.—Helped by natural gas development, industrial production has risen at annual rates of *ca* 9% during the last 5 years, and rehabilitation of the distressed areas of the S. has begun. New regulations permitting foreign investors to transfer abroad profits and dividends from productive investment, and to repatriate their capital, have attracted a substantial volume of foreign funds. Unfortunately, the attitude of the Italian Government and public towards foreign petroleum prospectors is clouded with prejudice, and the recently promulgated Oil Law contains repugnant clauses. With the rapid increase in industrial production energy consumption has doubled since 1949, the extra energy being consumed largely in the form of natural gas and oil. Natural gas availability from local resources has increased from 249 million m³ in 1949 to 4465 million m³ in 1956. Oil demand has risen in the same period from 4 to *ca* 11 million tons. A new Oil Law promulgated in 1957 (see *Petrol. Press Serv.*, May 1956, p. 162) has proved disappointing, and confirms ENI's virtual monopoly in the Po valley. The new law is not applicable to Sicily or Sardinia. In Sicily crude oil output may soon reach 2 million tons p.a. ENI is also a leading oil distributor, its most ambitious project abroad is exploration in Persia (see *Petrol. Press Serv.*, May 1957, p. 173). Nuclear power industry promotion is a further activity. Refining capacity is rated at 27,863,000 tons p.a. R. T.

317. Adjustments in Colombia. Anon. *Petrol. Press Serv.*, 1957, **24**, 334–7.—Measures introduced by the new Colombian Government—supported by foreign loans—are intended to solve her adverse balance of payments and stabilize the Peso val. These measures will help the petroleum industry, which is exempt from the 15% deduction on proceeds of exports. Imports of oil industry machinery also are exempt from the 10% deduction made from currency required by importers. The immediate benefit to oil companies will be offset by a special surcharge to be levied on 1957 profits—designed to prevent gains due to devaluation—also by wage increases and introduction of levies for family allowances and apprentices. Colombia needs urgently to diversify her production, which explains the efforts made in recent years to make oil exploration attractive, and exceptions made under the new exchange regulations respecting the oil industry. Since the amendments introduced in 1955 (see *Petrol. Press Serv.*, April 1955, p. 136, and Sept. 1955, p. 339) production and exploration have increased. Last year production rose by *ca* 11% to over 44 million brl (approx 6·3 million metric tons), chiefly due to higher output from Texas Co's Velasquez field. With 24 wells now in production output is *ca* 4700 b.d., giving Texas an overall production of approx 28,600 b.d. Large concession areas have been granted or applied for in the Llanos, in the extreme SE.—where conditions are favourable—to Texas, International (Jersey Standard), and Royal Dutch Shell/Canadian Eagle. Colombia's own consumption continues to expand, and is now *ca* 15·5 million brl, but International's 25,000 b.d. Cartagena refinery, coming on stream shortly, will eliminate the need for products imports. R. T.

318. Perspective of development for petroleum industry in Poland. K. Tolwinski. *Nafta* (*Krakow*), 1957, **13**, 11–13.—Whilst the Central Carpathians are now exhausted, the foothills have yielded some gas. Exploratory work there must not be abandoned. N. plateau is certain to contain reserves of oil, and some promising discoveries have been made. Another region worthy of investigation is the Swietokrzyz (St Cross) Mountains. It is thought that it will be necessary to drill below 3000 m, and the construction and maintenance of suitable drilling equipment is of supreme importance.
M. S.

319. Key problems of Polish petroleum industry against the background of the general position of world oil industry. J. Wojnar. *Nafta* (*Krakow*), 1957, **13**, 8–11.—In a brief review of a century of the industry the author quotes estimates of world requirements at 1500 million tons p.a. by 1975 and reserves at 27,000 million tons known and 180,000 million tons possible. Whilst the U.S.A. was known to possess 50% of world's oil resources in 1939, now 66% is known to be found in the Middle East, 15% in the U.S.A., 8% in Europe. 15% of U.S. consumption is satisfied by imports, and in 1967 this fraction will rise to 25% of the 600 million tons total forecast. The Middle East resources, which were in 1937 in British hands to the extent of 80%, now are under American control in 65%. The U.S.A. still produces 44% of the world's crude. The 100 million tons of Middle East crude brought to Europe comes part of the way through pipelines carrying 20 million tons, and through the Suez canal goes 80 million tons. The distance from the Middle East oilfields to W. Europe around the Cape is twice as long as through the Canal, and the distance from the Mexican Gulf falls between the 2. Although native production in W. Europe is only 10 million tons p.a., it has risen over the last 20 years tenfold, particularly in NW. Germany. In U.S.S.R. production rose from 30 million tons p.a. in the 1930–50 period to the present figure of 80 million tons p.a. in the space of 3–4 years, and only 20% of it comes from beyond the Caucasus. Figures for Hungary, Bulgaria, and Albania are given as 1·5, 0·3, and 0·35 million tons, whilst Rumania is said to produce 11 million tons p.a., mainly from regions outside the Carpathians. Polish production, now *ca* 185,000 tons, can rise only if the N. lowlands are tapped. Plans for 1960 envisage 170,000 tons of crude and *ca* 85,000 m drilled annually between 1956 and 1960. This is less than before, and contrary to the postulated 50% rise. Each exploratory m drilled in the Carpathians brings on the average ½ ton in the following year. The fall in production of old wells is 15% (25,000 tons p.a.), so 50,000 m of exploratory drilling is required to maintain production. However, only 20,000 m of the 85,000 m planned is for exploration. Now the primary need of the Polish petroleum industry is to raise the drilling figure to 100,000 m in 1957 and 500,000 m by 1960. Discovery of oil would save foreign currency. Another need is the building of a new (sixth) refinery of 1 million tons p.a. throughput. If consumption in 1960 reaches 3 million tons, and unless this refinery is built, Poland will have to buy over 1·5 million tons of finished products. It is worth noting that no extra funds are considered necessary for these plans.
M. S.

320. Fifth scientific technical gas conference. W. Kolodziej. *Nafta* (*Krakow*), 1957, **13**, 42–4.—Conference took place on 27–28 Sept. 1956 in Krakow and covered reports from France, Vienna, OEEC, and from Polish gas works. The other countries' work was pointed to as an example for Polish planning. Due to shortage of coking coals, underground gasification would be the best answer, and to lower costs a grid is necessary. Natural gas is needed, but all the work must be placed in one organization. Drilling in the triangle Lodz–Warsaw–Radom should be started to find suitable underground reservoirs. Further technical training is of utmost importance.
M. S.

321. Foreign review. Z. Onyszkiewicz *et al*. *Nafta* (*Krakow*), 1957, **13**, 52–8.—A number of short items including: (1) The description of the organization of the French IP; this has been created by a Government decree, and its duties are research and investigations, education of engineers and technicians, and, finally, documentation. A certain fraction of the price of petroleum products goes directly to the funds of the Institute. The author gives an outline of sections and divisions of the Institute. (2) Report from the French gas congress—2–7 July 1956. (3) Soviet aims in the sphere of storage of crude and oil products: new oil storage depots are planned, and old ones are to be expanded. Distribution of products from single centres has proved a great saving, in particular to great centres like Moscow. Pressure vessels have long been recognized as a necessary investment, but it has been decided to build for pressures lower than previously recommended. (4) Refining industry in the U.S.S.R. Over the last 10 years production of crude has been rising at the rate of 14% p.a. and production of "white" products by 30% p.a. However, the production of crude now includes a large proportion of sulphuretted hydrocarbons. Methods have been devised to deal with this problem without external addition of H_2. Refining is aimed at fuels and lubricants with large-scale cracking in operation, and the gases are used for the manufacture of high octane fuels. Lubricants are solvent-refined, and so are waxes and asphalts. Contact processes play a large part in the production of "white" oils. In research a great part is played by local petroleum institutes. (5) Scientific research institute in Tartary. Due to high production from the Tartar fields, the establishment of an institute has become imperative. It will receive a library from the Ministry, and will carry out research into all branches of petroleum technology. Other reviews are based on German journals.
M. S.

322. The role of technical intelligentsia in the development of petroleum industry in Poland. Anon. *Nafta* (*Krakow*), 1957, **13**, 1–5.—In petroleum industry even the greatest efforts may produce insignificant results. In the middle of the nineteenth century, due to the unfavourable political circumstances in Poland, men of ingenuity like Lukasiewicz, Wolski, and Mikucki contributed to development of drilling in the Caucasus and Canada more than they did in Poland. Since 1918 the names of Huber, Moscicki, and Pilat have been added to the world's oil experts. Since 1945 the present generation, who are their pupils, have striven to repair the ravages of war and now are faced with practically exhausted resources. Production of crude in Poland is now *ca* 180,000 tons p.a., *i.e.* only 11% of the country's requirements. Little as yet has been done about discovering new oilfields; on the other hand, since 1945 the structure of the Polish oil industry has been reorganized 14 times. The Association of Petroleum Engineers and Scientists should take a lead in the search for oil as well as in the defence of the status, qualifications, and income of the engineer.
M. S.

323. Your design reference file. VI. R. Cushing. *Chem. Engng*, 1957, **64** (9), 277–82.—A list of useful refs is given on heat transfer, heat exchangers, chemical engineering, and kinetics, with notes on each ref.
P. J. O.

324. How to purify helium on a big scale. Anon. *Chem. Engng*, 1957, **64** (8), 146.—The removal of impurities from helium down to 200 p.p.m. by combined refrigeration and adsorption is envisaged for zirconium forging and rolling operations.
P. J. O.

325. Mechanical energy improves diffusional separations. H. F. Wiegandt. *Chem. Engng*, 1957, **64** (8), 273–9.—The author discusses the application of mechanical energy to a

number of processes, including mol dist, gas absorption, and liq–liq extraction. P. J. O.

326. Socony tries new plan. Anon. *Chem. Engng News*, 24.6.57, 38–9.—After a year, the operation of Mobil Overseas Oil Co., an American co-ordinating body, is considered. Management training for overseas employees has been particularly successful. R. T. T. B.

327. Oil firms boost earnings. Anon. *Chem. Engng News*, 27.5.57, 86.—Increases in the sales and operating revenue and of the net income of 14 major U.S. oil firms are shown. R. T. T. B.

328. Combined heat and moisture insulation for flat roofs. H. Walther. *Bitumen, Teere, Asphalte, Peche*, 1956, **7** (5), 198–200.—In an interesting article on combined heat and moisture insulation in roof construction—flat and slightly inclined—in Russia, bitumen is used as protection against air–water vapour migration. R. T.

329. Board of directors expands petroleum research. Anon. *Chem. Engng News*, 13.5.57, 66–80.—A summary of the A.C.S. policy for the forthcoming year with full details of projected divisional programmes. R. T. T. B.

BOOK REVIEWS

Properties of Petroleum Reservoir Fluids. Emil J. Burcik. New York: John Wiley & Sons, Inc. London: Chapmand and Hall, 1957. Pp. ix + 190. 60*s*.

This book covers the subject matter of a petroleum engineering course at the Pennsylvania State University and is written primarily for students. In such a case it is always something of a problem to decide where to make a beginning. Here in the first chapter the student is introduced briefly to the very fundamentals of structural organic chemistry (but surely one who needs this introduction would also need to be told something of the concept of valency, which is suddenly brought in without warning or explanation?). The next four chapters lead on from the perfect gas laws and the phase behaviour of simple liquids to the greater complexities of non-perfect fluids and multi-component hydrocarbon systems and take in their stride such matters as retrograde phenomena or the use of equilibrium constants. The development is clear and logical and may be useful, not only to the student and to the technician who has begun at the other end with the operation of experimental apparatus, but also perhaps as a refresher to those whose student days are past. (There is, however, something of a confusion on p. 40 over the Cox chart with an " entirely arbitrary " temperature scale and the alternative of plotting against $1/T$: the two charts are, as they must be, essentially the same. In passing, the scale in Fig 15 is logarithmic, but the figures refer to vapour pressure, not log vapour pressure).

In the sixth chapter attention is transferred to conventional oil reservoirs with a useful compilation from various sources of empirical methods for approximate estimation of the basic fluid characteristics commonly used in reservoir analysis, and at the end some indication is given of the methods used for their experimental determination. But the change from basic physical chemistry to pure empiricism is so abrupt that the student may well be forgiven for wondering what the previous chapters have been leading up to. Even some reference to other types of reservoir would help to restore the balance. Here, too, for the first time some dynamic considerations, of fluid flow, are introduced.

Finally, the various concepts that have been examined in the previous chapter are combined into equations for the solution of elementary problems in various basic types of reservoir. Here a word of caution is necessary: the idealization of the reservoirs, and the natural emphasis in this book on the fluids themselves, gives a dangerously false impression of simplicity to such matters as the determination of the oil in place or the part played by the aquifer in the system, which are fundamental to the problem.

A helpful feature of the book is the provision of worked examples of calculations and a collection of problems at the end of each chapter, though it is not clear what is the value of providing answers to just a few of these: the student who is attending a course should have no need of any of them, the student who is on his own would wish to be able to check his working of all. H. A. F.

AnalaR Standards for Laboratory Chemicals. 5th Edition. London: Eyre & Spottiswoode Ltd. Pp. 397 + xvi.

It is now eight years since the last edition of this publication on AnalaR Standards was published jointly by the British Drug Houses Ltd and Hopkin & Williams Ltd. It is now published by Eyre & Spottiswoode Ltd, but retains its previous style and format. Fourteen new reagents appear in this revised edition, including ethanol, toluene, and xylene, and twelve items which were included in the 4th edition have been discontinued for various reasons.

There has been some rearrangement in the book itself due to the adoption of the recommended names for chemicals set out in BS 2474 : 1954.

In addition to the specifications of analytical reagents, details are given of reagents used in testing " AnalaR " chemicals, the Karl Fischer test for water, and similar data.

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OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

330. Drillers take a look at automation. W. C. Gresham *et al.* *Oil Gas J.*, 12.8.57, **55** (32), 101.—A new automatic weight control device has been successfully tested in the Rocky Mountain area and has shown marked improvements over earlier types because of its accuracy, low cost and maintenance, and its portability and ease of installation.

Locally, use of the equipment has raised penetration rates from 7 to 50% above manual control and there has been appreciable improvement in bit life. The device operates electronically and comprises a deadline tension measuring device which senses weight, a control mechanism, and a line-releasing mechanism. These units are briefly described, together with their methods of operation.

Although the equipment can be used with penetration rates up to 3 ft/min, it should not be used for rates over one ft/min. With the higher rates pump capacity is a more important factor than weight control.

Diagrams show the results of using the equipment in test wells. C. A. F.

331. Known existing traps offered clues to deeply hidden Edwards. R. M. Knebel and F. C. Jones. *Oil Gas J.*, 5.8.57, **55** (31), 152.—8 fields producing from the Edwards limestone in Atascosa County, Texas, are briefly described. Each of

D

them produces from the upthrown block of a fault which has an upthrow to the SE. The fields are Pleasonton, E. Imogene, Imogene, Jourdanton, Charlotte, Muil, Fashing, and an unnamed field between the Imogene fields. A typical field is Pleasonton, discovered in 1951, where the Edwards is at *ca* 7700 ft below sea level. Upthrow along the fault is over 400 ft, sealing the limestone against impervious younger beds. Vertical closure is *ca* 200 ft with a productive area of *ca* 885 acres. The pay is fossiliferous limestone averaging 15·6% porosity and 4 mD permeability. Connate water saturation is 22%. Pressure maintenance since 1953 has boosted production, and estimated reserves are 9 million brl oil and condensate and 31 billion cu. ft. gas. Structure maps show the structure of Pleasonton and other fields in the area. 4 refs.
C. A. F.

332. The Fashing fault find. R. M. Knebel. *Petrol. Engr*, 1957, **29** (2), B21–3.—A natural gas reservoir has been discovered on the Fashing fault block in S. Texas. Gas was present in a lime fault zone 580 ft thick, the whole of which was productive of gas and condensate. E. A. G. H.

333. Test hits 19,078 ft for Texas depth record. Anon. *Oil Gas J.*, 12.8.57, **55** (32), 69.—1-CS University, *ca* 13 miles SE. of Fort Stockton, Texas, has been drilled to 19,078 ft and is now the deepest well in the state. It is expected to drill another 500–1000 ft. The test was drilled for the Ellenburger, expected at *ca* 16,000 ft, but at present depth the Devonian has not been reached and the well is in the Mississippian Barnett shale. Nearest production from the Ellenburger is in the Packett field, 12 miles to the SE. C. A. F.

334. Deep Edwards strikes point to future jackpots in South Texas. C. E. Kimmell. *Oil Gas J.*, 5.8.57, **55** (31), 158.—Since 1953 10 gas fields have been found producing from the Edwards limestone in La Salle and McMullen counties, Texas. These form a trend along which stratigraphical conditions are uncertain. An interpretation of the stratigraphy is briefly described in which it is suggested that the Edwards reef is composed of bioclastics built up by wave action. Faulting is associated with all the fields, but these alone are not thought to control the accumulations, as structural closure is present.
C. A. F.

335. A blowout points up a lesson. F. J. Gardner. *Oil Gas J.*, 5.8.57, **55** (31), 151.—A blowout of a 15,000-ft wildcat in Terrell County, SW. Texas, has drawn attention to the neglect of the oil possibilities of this area, which is known as the Val Verde basin. Little subsurface data is available, but it is thought to be connected to the Delaware basin to the NW. by the Sheffield channel. In the blowout, 1 Brown-Bassett, gas and dist were produced at *ca* 75,000 M.c.f/day from Devonian in a new pay, and the loss is estimated at $450,000. The only other production in Terrell County is the Spencer field, where gas in the Permian Wichita–Albany was found in 1953.
C. A. F.

336. How pure geology works at Natchez. Pt 1. G. W. Gulmon, H. E. Hansen, and B. L. Simms. *Oil Gas J.*, 5.8.57, **55** (31), 72.—The exploration and discovery of oil in the Natchez area of Louisiana and Mississippi are described. The first phase of exploration was geophysical, and this was followed by the finding of a few prolific Cretaceous discoveries associated with deep-seated salt domes. After 1944 subsurface geological interpretation proved successful in locating Wilcox production. The regional geology of the area is discussed, with emphasis on Wilcox stratigraphy and structure. There is active interest in the area, for drilling is shallow, oil is of good quality, and most sands show good recovery rates with reasonable production costs. Pays are Eocene Wilcox sands and the Cretaceous Tuscaloosa. The fields of the area are listed. 4 refs. C. A. F.

337. New dome found. Anon. *Oil Gas J.*, 12.8.57, **55** (32), 85.—The second salt dome in Alabama has been found by 1 Champion-Klepac in S. Clarke County, which was abandoned as dry at 15,300 ft after penetrating 4124 ft of salt. The dome is deep-seated and of non-piercement type, whereas the first dome at McIntosh is a shallow piercement dome with the top at *ca* 400 ft. Both domes are in the E. end of the Louisiana–Mississippi Interior basin. C. A. F.

338. Irion County—graveyard turned goldmine. M. A. Eidelbach and O. Denman. *Petrol. Engr*, 1957, **29** (1), B76–81.—New oil discoveries have been recorded in the Permian basin. Regional geology is described and drilling problems reported. Oil occurred in sandstone deposits at depths of 4300–6900 ft.
E. A. G. H.

339. Arbuckle region offers good possibilities. C. A. Caswell. *Oil Gas J.*, 22.7.57, **55** (29), 158.—The geology and oil possibilities of the Arbuckle Mountains area of S. Oklahoma are outlined. Important potential structural traps are present and reservoir conditions are favourable, but geological conditions are very complex, and the location of fields requires careful co-ordination of geology, geophysics, and drilling.

Thrust faulting is one of the complicating factors in subsurface interpretation: *e.g.* in the SE. Hoover field production comes from the Arbuckle with trapping against a NW.–SE. trending thrust fault, but the beds below the thrust have been inadequately tested. This emphasizes the importance of drilling in locating new fields. A series of diagrams shows the structural complexities of the area. C. A. F.

340. Wyoming well hits. Anon. *Oil Gas J.*, 5.8.57. **55** (31), 57.—1 Union Pacific–Anschutz, 6 miles SW. of South Big Medicine Bow field in central Wyoming on test flowed over 4000 b.d. from the Jurassic Sundance sand at 6485–6519 ft. Oil gravity is 43°. The well is in the E. part of the Hannah basin, which is an E. embayment of the Wind River basin.
C. A. F.

341. Colombia well hits. Anon. *Oil Gas J.*, 5.8.57, **55** (31), 63.—Gualanday 3 in the Upper Magdalena Valley of Colombia on test produced 840 b.d. of 38° oil. Total depth was *ca* 8000 ft, and details of the producing zone have not been given. The well is *ca* 35 miles N. of the Tetuan field and is claimed to be the most promising wildcat for several years. C. A. F.

342. Basic pattern of exploration in Saudi Arabia remains unchanged. Pt 2. W. H. Thralls and R. C. Hasson. *Oil Gas J.*, 22.7.57, **55** (29), 91.—The stratigraphy and structure of Saudi Arabia in relation to the fields along the W. side of the Persian Gulf are broadly described, together with the methods used for handling and processing the produced oil.

Formations range from Palæozoic to post-Cretaceous, with production from the Jurassic (Arab, Hadriya, and Fadhili zones) and the Cretaceous (Ratawi, Zubair, and Bahrain zones). Tables show the generalized stratigraphy and correlation between the coastal Hasa area and the type outcrop section.

The main structural provinces consist of the pre-Cambrian complex to the W., flanked to the N., E., and S. by a series of large features which includes the Hasa structural terrace, within which are all the producing areas on the W. side of the Persian Gulf. It consists of a slightly warped surface on which is superimposed a series of N.–S. trending anticlinal axes, the 2 most important being En Nala and Abqaiq-Qatif. The structures of the fields along these axes are briefly described, and a table lists the producing zones of the fields, together with oil gravity, producing depth, and estimated productive areas.

After separation and stabilization (to remove H_2S) the oil is piped to the refineries at Ras Tanura and Bahrain, or through the Trans-Arabian pipeline to the Mediterranean.

It is also shipped as crude through the Ras Tanura marine terminal. C. A. F.

343. Oil found in Dhofar. Anon. *Oil Gas J.*, 5.8.57, **55** (31), 62.—4 wells have recently been drilled in Dhofar between Oman and the Aden Protectorate. One of these, Marmul 2, is reported to have tested 2000 b.d. of 22° oil from 3200 ft, and the well is being deepened. Marmul 1, tested about a year ago, is now reported to have a similar potential production. These 2 wells are on a structure 11 miles by 5 miles, situated 35 miles from the coast. Other wells in the general region have recently been drilled in Oman and the Trucial Coast. These have all been dry. C. A. F.

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

344. How geophysics provides deep Edwards data. Pt 2. W. L. Moore. *Oil Gas J.*, 12.8.57, **55** (32), 166.—The search for Edwards limestone fields in S. Texas has been aided by gravity and seismic surveys which can provide very useful data on trends in the area. Examples of a gravity map and profile and seismic profiles are given and discussed, the gravity profile across the Luling field, for example, shows higher values on the upthrown side of the faulting, where denser rocks are closer to the surface. Seismic profiles show strong Edwards reflections, and it is possible to observe faulting on matched profiles.

It is emphasized that success in the exploration of the area requires close co-operation between the geologist and geophysicist. C. A. F.

DRILLING

345. Air and gas drilling gain prestige. J. H. Adams. *Oil Gas J.*, 12.8.57, **55** (32), 123.—Air and gas have been used as circulating media in drilling hard rock in the McAlester basin of E. Oklahoma and NW. Arkansas, and the results from several wells show that the use of these media has been very successful. Penetration rate has been increased by 184% and average footage per bit by 630%, with optimum rotary speeds ranging from 40 to 60 rev/min and bit life (in hard Atoka shale) ranging from 300 to 350 ton-hr at optimum speed. It was found that air velocities below 2000 ft/min were insufficient to remove cuttings below 4700 ft.

The results of drilling of 5 wells with air and gas are briefly described and possible future improvements outlined. In certain areas reverse circulation may give better performance, and bits specially designed for air drilling would give improved bit life. 2 refs. C. A. F.

346. Air drilling pays dividends. L. Radford. *Petrol. Engr*, 1957, **29** (1), B21–7.—Successful air drilling of 3 wells is recorded. In comparison with conventional methods, air drilling is less costly, due to a faster penetration rate. Powdery samples provided difficulties. E. A. G. H.

347. How to speed drilling in shale. R. A. Cunningham and W. C. Goins, Jr. *Oil Gas J.*, 5.8.57, **55** (31), 88.—The quality of drilling mud has a great influence on drilling rate in shales; in the Gulf Coast area, for example, shales tend to become gummy and cause bit balling under certain conditions, but the use of oil in lime-base muds has improved drilling speed by up to 150% and reduced balling. The results of tests in a micro bit drilling machine in order to observe the behaviour of bit and drilling fluid have also shown that lowering mud fluid loss from 13·4 to 2·4 cc by adding starch reduced drilling rates by *ca* 20%. Balling is caused by kneaded shale forming a thick paste which extrudes up around the bit. Jet action of the bit can remove most of this.

Tables and graphs show the results of the tests. C. A. F.

348. DE—an aid to cementing casing through salt zones. F. T. Shell. *Petrol Engr*, 1957, **29** (3), B100–10.—Lab tests showed that amounts of diatomaceous earth (DE) added to cement slurries reduced the adverse effect of sodium chloride on the compressive strength of Portland cement. Increasing the DE content lowered the strength of the cement for low concn of sodium chloride. The DE cement has a low density, low expansion on setting, and sulphate resistance. E. A. G. H.

349. How to determine hole curvature. A. Lubinski *et al.* *Petrol. Engr*, 1957, **29** (2), B42–7.—Early determination of any deviation of a hole from a straight path is desirable, otherwise drilling problems may result. A new chart is presented enabling the hole curvature to be read directly, knowing the distance and change of vertical and horizontal angles between 2 stations in the hole. E. A. G. H.

350. How straight does a hole need to be? H. Faulk, H. N. Stansbury, R. M. Willis, and A. B. Janco. *Petrol. Engr*, 1957, **29** (3), B31–5.—Drilling efficiency is lost due to hole deviation control. It is suggested that relaxed limitations on hole deviation would reduce drilling costs without increasing operation costs. E. A. G. H.

351. New shaped charge packs bigger wallop. J. E. Kastrop. *Petrol. Engr*, 1957, **29** (1), B66–72.—Jet penetration into cement targets showed that the new charge increases hole vol and entrance hole size appreciably, compared with present shaped charges. E. A. G. H.

352. Blowout prevention. T. Gaines. *Petrol. Engr*, 1957, **29** (2), B28–30.—Most blowouts can be prevented by the execution of a safe drilling plan. The rig should be properly supplied with equipment and safety devices, and the crew trained to swiftly carry out preventive operations. E. A. G. H.

353. Effect of modern drilling technology on well cost. D. Ragland. *Petrol. Engr*, 1957, **29** (1), B33–6.—An outline is given of basic research in drilling which has improved drilling efficiency and stabilized well costs in the U.S.A. E. A. G. H.

354. High temperature cooling for drilling engines. D. M. Taylor. *Petrol. Engr*, 1957, **29** (3), B36–42.—By converting drilling engines for use with high temp or vapour phase cooling, the h.p. of the engines was raised, while operating and maintenance costs were reduced. E. A. G. H.

355. New magnetic particle brake. J. A. LeVelle. *Petrol. Engr*, 1957, **29** (1), B47–52.—The unit is a modified electromagnetic brake, has a constant braking torque, is compact, and combines a drawworks brake and drilling feed control. E. A. G. H.

356. Tongs and power tongs. C. E. Murphy. *Petrol. Engr*, 1957, **29** (1), B124.—Various types of tongs used in drilling are surveyed. E. A. G. H.

357. Wire rope. J. Walker. *Petrol. Engr*, 1957, **29** (2), B53–60.—Properties of wire rope used in drilling are set out. Examples of hoisting system calculations are given. E. A. G. H.

358. What you should know about oilfield chain. H. Reid. *Petrol. Engr*, 1957, **29** (2), B130–8.—4 grades of chain suitable for drilling and hauling operations are described. Proper selection may reduce equipping and maintenance costs. E. A. G. H.

359. Parallel macaroni string cuts well costs. H. U. Garrett and D. M. Taylor. *Petrol. Engr*, **29** (1), B38–44.—A narrow bore tube parallel to the main tubing, instead of a production

casing, connects the lower part of the tubing to the surface for well control. Well completion using the new technique is described. Savings resulted in completion costs and working costs in 19 wells. E. A. G. H.

360. Core samples pulled in hurry. Anon. *Oil Gas J.*, 12.8.57, **55** (32), 68.—A new coring device is described which eliminates the need for pulling drill pipe when a core is required. It is run inside the drill pipe, and consists of a sampler 7 ft in length which cuts a core 4–5 inches in length and *ca* one inch in diameter. The core is cut by a bit rotated by a fluid motor actuated by the mud. The core bit rotates at 45° into the formation so that samples can be taken at bottom or at any point in the well. The sampler is withdrawn from the pipe by a wire line, and during the coring cycle the drill pipe is stationary whilst mud circulation is maintained. The device has been tested in the Rocky Mountain area. C. A. F.

PRODUCTION

361. Homogeneous fluid flow through consolidated porous media. R. T. Johansen and H. N. Dunning. *J. Coll. Sci.*, 1957, **12** (1), 68–79.—The flow of fluids in a natural petroleum reservoir usually involves a multiphase system of gases and liq flowing through heterogeneous porous materials. However, a prerequisite of understanding such a complicated system is the understanding of a simple, homogeneous system. Previously, investigations have been carried out for single phase flow through unconsolidated sand, and other consolidated media. Several anomalies arose, some of which have been solved, but 2 still remain controversial subjects. These are the increase in permeability to an electrolyte soln accompanying an increase in concn, and an increase in permeability when the surface of the porous medium is made non-wetting to the flowing liq. Therefore these effects were investigated to determine the applicability of Poiseuille's Law to the flow of homogeneous fluids through inert, consolidated, porous media. M. J. R.

362. Secondary recovery: early and late. F. Squires. *Petrol. Engr*, 1957, **29** (2), B80–98.—Various methods of increasing oil recovery from wells are reviewed, including vacuum, repressuring with gas, water flooding, a combination of gas and water injection, and, lastly, heat combined with repressuring, which is dealt with in detail. The cost of oil produced by the heat experiment exceeded its value. Other experiments showed that oil occurring in sands contacting lower coal deposits may be recovered by setting the coal seam on fire. Hot combustion products evaporate the oil, and the mixture of gases issues through the annulus of the air input well. E. A. G. H.

363. Tax value of secondary recovery production. R. T. Savage. *Petrol. Engr*, 1957, **29** (3), B90–8.—In a discussion on the value of oil produced by secondary recovery, the effect of gas and water injection is shown graphically to have increased the potential production of several oilfields. E. A. G. H.

364. Water in the production of oil. P. D. Torrey. *Petrol. Engr*, 1957, **29** (1), B83–98.—Already, almost ¼ of Texas' oil production depends on the use of water. 10–15 vol of water are injected into the reservoir for each vol of oil produced. Most water is used initially, when the reservoir pore system is filled at a rate of 1–2 b.d. of water/acre-ft of reservoir rock. After this stage the rate is halved. For pressure maintenance, water of twice the oil vol produced is injected. Fresh water sources, the use of salt water for injection, and water treatment are discussed. Water penetration is reduced by plugging of the reservoir rocks when wetted clay swells. A method of swelling control is described. E. A. G. H.

365. Corrosion inhibitor injection via the liquid type dump bailer. V. W. Maxwell. *Petrol. Engr*, 1957, **29** (2), B102–6.—During injection of corrosion inhibitor into well casings, the protective film was not complete and corrosion occurred at the well bottom. A wire-line, liq-type dump bailer was designed for complete protection of the tubing. Advantages, disadvantages, and economics of the dump bailer are discussed. E. A. G. H.

366. Complete automation in water injection. R. H. Travis. *Petrol. Engr*, 1957, **29** (2), B76–8.—Electrodes in the water leg of reservoir tanks in conjunction with the water level automatically control valves and pumps of a well water injection system. Operating labour and maintenance costs are reduced to a minimum. E. A. G. H.

367. New flood uses butane. Anon. *Oil Gas J.*, 12.8.57, **55** (32), 70.—A pilot flood project in the W. Pampa part of Panhandle field in Gray County, Texas, is using butane as an injection fluid. The project covers *ca* 40 acres, and the pay is Brown dolomite at *ca* 3200 ft. Oil in place in the pilot area is estimated at 1,231,000 brl, of which the butane should recover 420,000 brl. ROS at abandonment is expected to be 26% instead of 50·2%.

It is planned to inject butane at *ca* 500 b.d., depending on its availability. At present the project makes use of a surplus of butane which would otherwise be wasted. C. A. F.

368. Blast helps fracture. Anon. *Oil Gas J.*, 29.7.57, **55** (30), 114.—A new fracturing tool is described for use in formations which normally resist conventional fluid injection. It is the Frac-Assist, which is a pressure boosting tool, and it is fixed in the tubing string immediately above the perforation opposite the zone to be treated. Normal injection procedures are carried out except that the hydraulic force is augmented by triggering the tool as follows: a tubing plug in the fluid stream enters the tool and compresses a firing cam. This detonates cartridges which fire a gas-generating propellant and a downward surge is generated, causing the fracturing fluid to be forced into the formation. The normal flow of fluid continues behind the surge. Field tests, which are briefly described, have proved very successful. C. A. F.

369. How fracture initiation can be controlled. B. Gilbert, G. Neill, and R. Clark. *Oil Gas J.*, 5.8.57, **55** (31), 64.—Tests carried out to determine how to control: (1) fractures at the point of initiation in the well bore, and (2) the plane in which they are opened and extended, have shown that it is possible to form at will, either horizontal fractures in a nearly uniform plane, or vertical fractures in any desired plane, by applying a new process in which the fractures are initiated by first shooting 2 sets of 3 parallel holes in opposite directions opposite the required zone in the well, and then placing a breakdown fluid across this zone before applying pressure in the conventional way. Photographs of the technique are included. 6 refs. C. A. F.

370. New tool controls well fractures. Anon. *Oil Gas J.*, 5.8.57, **55** (31), 54.—A new perforating tool is briefly described which forms part of a fracturing service called Fracture Initiation. The tool jets 6 holes in the pipe in the same horizontal plane by means of shaped charges to give 2 sets of 3 parallel holes in opposite directions. On test the tool gave successful results; after perforating test blocks and pouring fluid into the perforations horizontal fractures were formed. Breakdown pressures have generally been lower than with conventional tools, and another advantage is that the tool disintegrates into fine pieces after firing so that clean out is eliminated. Photographs show the tool and test results. C. A. F.

371. Pressure maintenance in the Goldsmith field. Anon. *Petrol. Engr*, 1957, **29** (1), B28–32.—The injection of water below the oil–water contact and gas in the gas cap of the Goldsmith field is maintaining the reservoir pressure.
E. A. G. H.

372. Packaged compressors cut production costs. D. M. Taylor. *Petrol. Engr*, 1957, **29** (3), B48–52.—Portable compressor units may be added or removed at a field compressor station as required by production. Costs are low and salvage value is appreciable. E. A. G. H.

373. Pneumatic LACT system trims labour, maintenance costs. Anon. *Petrol. Engr*, 1957, **29** (1), B104–5.—Stanolind Oil and Gas Co has designed a lease automatic custody transfer (LACT) unit which is pneumatically controlled, and it is stated that the simple design costs less to erect and maintain.
E. A. G. H.

374. Automatic custody transfer of crude oil. H. C. Packard, H. S. Kelly, and A. H. Newberg. *Petrol. Engr*, 1957, **29** (2), B31–40.—Equipment has been developed to measure the quantity and quality, and to run the crude oil from the producers' leases to the pipeline completely automatically. The process is known as lease automatic custody transfer (LACT). For volumes of over 100 b.d. the initial investment for a LACT battery is less than for an equivalent manually-operated system. Better and safer use of manpower and increased conservation of natural resources result. Human errors and disagreements, recording errors, and evaporation losses during measuring are reduced.
E. A. G. H.

375. New latex-cement solves special well problems. J. T. Rollins and R. D. Davidson. *Petrol. Engr*, 1957, **29** (2), B48–51.—The new cement consists of latex, cement, a surface-active agent, and water. Advantages of the material include stronger bonding with surfaces, greater resilience, resistance to contamination, low fluid loss and shrinkage, and greater durability. Applications of the cement in cementing liners, tail-in jobs, and squeeze jobs are described. E. A. G. H.

376. Principles and practices of cementing. D. F. Jahns. *Petrol. Engr*, 1957, **29** (3), B64–80.—Casing and cementing operations account for 20–30% of well costs, thus satisfactory completion and production require good cementing techniques. The effect of adding to normal cement various materials, which alter properties such as thickening time, compressive strength, water loss, etc., is discussed. Cementing equipment and tools for well completion are described. E. A. G. H.

377. Hydraulic horsepower requirements for well treatments. R. W. Brown and G. H. Neill. *Petrol. Engr*, 1957, **29** (3), B53–62.—A rapid and fairly accurate method using charts and graphs is presented to calculate hydraulic h.p. required during well injection to acidify or fracture formations.
E. A. G. H.

OILFIELD DEVELOPMENT

378. Canada is optimistic—and justly so. Anon. *Oil Gas J.*, 29.7.57, **55** (30), 160.—There are 740,000 sq. miles of potential oil country in Canada, but only 230,000 sq. miles has been at all explored. Within 10 years 3½ billion brl have been discovered with over 20 trillion cu. ft. of gas. Discoveries and developments were again at a high level in 1956, the wildcat success ratio being *ca* 1 : 3.

The developments of W. Canada have not been matched in E. Canada, but there has been renewed wildcatting in the latter area, important gas reserves being found in Ontario, under Lake Erie, and in the St Lawrence Lowlands.

It has been estimated that the industry has spent approx $1/brl found during the past 10 years. C. A. F.

379. Neutral Zone output rising. Anon. *Oil Gas J.*, 5.8.57, **55** (31), 63.—Production from the Neutral Zone between Kuwait and Saudi Arabia at the beginning of the year was reported at 45,800 b.d. from the Wafra field, where pays are Burgan sands at *ca* 3000 ft. Development drilling is nearly complete, but there is interest in the deeper Ratawi zone at 6750 ft and the shallow Eocene at 1250 ft.

The capacity of the pipeline in the Zone is to be augmented in order to handle the increased production. At present this 34-mile line runs from the field to a terminal at Mina Abdulla on the coast. C. A. F.

380. Sahara offers French oil freedom. Anon. *Oil Gas J.*, 29.7.57, **55** (30), 122.—Recent oil developments in the Sahara are briefly described. In the deep field at Hassi Messaoud in E. Algeria, which is being developed by two companies, there are 3 producers and 4 wells are being drilled. 120 miles to the NW. of this field gas was found at *ca* 7000 ft, and it is to be tested. Another well in the general area found a similar section. Farther N., Guerrara 1, which is below 11,000 ft, has had several shows and is to be tested. Also in this general area are Bordj Nili 1, which is in the Jurassic below 6000 ft, and Ab 2, drilling below 7000 ft. It is expected that geophysical work, temporarily suspended for climatic reasons, will soon be resumed.

It is also expected that oil will be transported from Hassi Messaoud to the railway at Touggourt from early 1958, and it is hoped that a large dia pipeline can be completed to Bougie on the Mediterranean coast during the next 18 months.
C. A. F.

381. Oil in the Sahara. M. Moyal. *World Petrol.*, 1957, **28** (6), 34.—Recent oil discoveries in the Sahara area are of particular importance to France and W. Europe because of their strategic position, and although the fields are isolated, it is probable that the area contains a number of others awaiting discovery. Geological and geophysical work have shown that there are 3 areas of N. Algeria which are prospective: (1) the Eocene basin of the Hodna, adjacent to the Mediterranean, in which the Oued Gueterini field was found: (2) the N. edges of the high plateaux; and (3) the area E. of Constantine. In addition, 3 other areas have proved encouraging: (1) the area around Ghardaia, in which the Hassi R'mel and Talemzane fields were found; (2) the Oued–Mya area 400 miles S. of the coast, where Hassi Messaoud was found, and (3) the Zarzaitine area in E. Sahara, proven productive by Edjele–Tiguorentine.

The discovery and development of the fields in these areas are described with geological data, and transport and communication problems are outlined. It is estimated that over 1·4 billion brl of reserves have been discovered in the area.
C. A. F.

382. Fezzan Province: an oil area? Anon. *Oil Gas J.*, 12.8.57, **55** (32), 92.—At least 6 companies now have concessions covering over 80,000 sq. miles in the Fezzan area of SW. Libya which borders the area of E. Algeria, where fields have recently been found at Edjele and Hassi Messaoud. A well is being drilled in the Fezzan, Haghe 1, and it is reported to have found oil sands above 1200 ft. C. A. F.

TRANSPORT AND STORAGE

383. Performance of a 26,350-ton tanker. Anon. *Mot. Ship*, Oct. 1957, **38** (449), 294.—Details are given of the performance of the 26,350-ton diesel tanker *Esso Aarhus*. It averaged a speed over 11 months service of 15·83 knots on 40·23 tons of oil daily. It has a 9-cyl B & W turbocharged engine of 740 mm cyl dia, 1600 mm piston stroke, and at 115 rev/min has an output of 11,900 i.h.p. D. K.

384. 30,000-ton tanker *Inger Knudsen*. Anon. *Mot. Ship*, Oct. 1957, **38** (449), 306.—The motive power is an 11,500-b.h.p. Götaverken 2-stroke turbocharged diesel with 10 cyl of 760 mm dia, piston stroke 1500 mm. This vessel differs from the conventional tanker in that all the accommodation is right aft with no 'midships structure. Several photographs and a plan of the vessel are included. D. K.

385. On trial. A tanker shows her paces. Anon. *Inst. Petrol. Rev.*, 1957, **11** (131), 300.—A description is given with acceptance and steering trials of the 16,000 dw ton tanker *British Vigilance*, built by Sir James Laing & Sons Ltd at Deptford, Sunderland. G. A. C.

386. Trends in pipeline valve control. H. A. Altorfer. *Instn & Automation*, 1957, **30** (4), 708.—The positive control of petroleum liq and gases is imperative for safety. 20 years ago power operation of valves on a large scale was practically unknown. However, complex valve installations are impractical without power operation, remote control, and automatic emergency functions. Valve controllers to-day fall into 2 main types, the electro- and pneumatic-mechanical operators. The first is a modern development of the geared motor drive which took the place of the conventional handwheel. The second is self-explanatory, but there is a further modification mentioned in the article, and that is the gas-hydraulic operator. Here, high pressure gas, which may be the pipeline medium, is led to tanks partially filled with hydraulic oil. The oil can then be used directly in the valve operator. M. J. R.

387. Concrete arch covers line in creek bed. L. Resen. *Oil Gas J.*, 21.10.57, **55** (42), 141.—A concrete arch is described, constructed to protect an exposed stream crossing the Shell Pipe Line Corpn's Rancho pipeline. The crossing is 45–50 ft wide and the protective arch extends 80 ft to provide for any future enlargement. G. A. C.

388. How T.G.T. gets top efficiency. O. H. Moore. *Petrol. Engr*, 1957, **29** (2), D39–42.—Improvements have been made to a high pressure gas transmission system. Raising the compression pressure of the engines through exchange of power cyl heads, cooling of the engine intake air, turbocharging engines, and installing large clearance cyl all led to fuel economy. Station piping re-design resulted in lower pressure drops. E. A. G. H.

389. Super pipeline bridge across the wide Missouri. C. A. McReynolds. *Petrol. Engr*, 1957, **29** (2), D34–8.—Erection of a pipeline suspension bridge carrying 2 30-inch gas lines is set out. E. A. G. H.

390. Pushbuttons take over booster station operation. H. Bell. *Petrol. Engr*, 1957, **29** (2), D29–33.—2 intermediate pipeline stations are being operated by remote control from a third station using a microwave system. E. A. G. H.

391. Construction is different in marsh-water areas. W. R. Bilbo. *Petrol. Engr*, 1957, **29** (2), D25–8.—High costs of construction, maintenance, and repair necessitate the building of a top quality pipeline in marsh-water areas. Equipment and techniques of construction are described. E. A. G. H.

392. Spanish pipeline designed for full mobilization. E. Corliss. *Petrol. Engr*, 1957, **29** (2), D20–4.—The construction of a pipeline to supply fuel to American air bases in Spain is outlined. The pipeline system is capable of reverse flow if the pipe is ruptured, and storage tanks are blast-resistant. E. A. G. H.

393. Pipeline communication and control. J. R. Neubauer. *Petrol. Engr*, 1957, **29** (1), D38–44.—To centralize the control of a large widespread undertaking, a combination of mobile VHF and microwave radio is suitable. Such a system is being used to control a natural gas pipeline. E. A. G. H.

394. Canadian outlook: biggest construction year. L. O. Rowland. *Petrol. Engr*, 1957, **29** (1), D54–8.—A record pipeline construction year in Canada is assured for 1957, according to contracts let and pending. The Alberta gas fields will be connected to Winnipeg, and a natural gas system 875 miles long is being laid in British Columbia. Other projects are outlined. E. A. G. H.

395. Assiniboine River crossed in winter weather. Anon. *Petrol. Engr*, 1957, **29** (1), D36–7.—A 260-ft length of 34-inch pipe was laid to carry a natural gas main over the river bed. E. A. G. H.

396. Overseas work has its problems. E. Allen. *Petrol. Engr*, 1957, **29** (1), D31–3.—Obstacles, some of which could not be foreseen, occurred during pipeline building in Turkey. E. A. G. H.

397. Primary factors that mean profits. J. H. Williams. *Petrol. Engr*, 1957, **29** (1), D28–30.—The factors which affect successful contracting for building pipeline in foreign countries are stated, and instances are related showing the influence of each factor. E. A. G. H.

398. Pipeline flow efficiency. Testing. 3. R. F. Bukacek and R. T. Ellington. *Oil Gas J.*, 30.9.57, **55** (39), 38.—This is the final article in the series and discusses errors which may occur in measuring various quantities; the effect each has on the final result is detailed. G. A. C.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

399. How to choose best reactor type. K. G. Denbigh. *Petrol. Refin.*, 1957, **36** (9), 271–2.—This article outlines several of the factors to be considered in deciding whether a reaction process should be operated batchwise or continuously to give the largest yield. The advantages of 2 types of continuous reactor, namely tubular and continuously-stirred tank reactors, are compared with reference to the effect of several reaction variables on the product yield. J. R. T.

400. Isovapor-lock chart for blending gasoline. T. W. Legatski and O. C. Bridgeman. *Oil Gas J.*, 21.10.57, **55** (42), 110.—A correlation is given for Reid vapour pressure, slope of the ASTM dist curve at the 10% points, ambient temp, and altitude, to assist in blending gasoline. G. A. C.

401. Design and application of CO boilers. E. Durham and M. B. Leland. *Petrol. Engr*, 1957, **29** (2), C38–42.—Various types of steam boilers, using the gas streams from refinery cat cracking unit renegerators as fuel, are described. E. A. G. H.

402. Ripple trays—a new tool for vapour–liquid contacting. M. H. Hutchinson and R. F. Baddour. *Petrol. Engr*, 1957, **29** (2), C6–9.—The design, construction, operational details, and applications of ripple trays are discussed. In comparison with bubble-cap trays of the same size, it is claimed that ripple trays have higher capacity at lower cost, and are insensitive to load changes. E. A. G. H.

403. Sky-high process pressures demand massive vessels. R. Meyer. *Petrol. Engr*, 1957, **29** (1), C6–11.—Heat exchanger design for high pressures requires large wall-thicknesses, which increase rapidly with the vessel dia. Fabrication methods for vessels of wall-thicknesses up to 15 inches, the use of pre-stressed metal to reduce wall-thickness, and the design of flanges and gaskets are described. E. A. G. H.

404. Welding and oil industry equipment. Anon. *Inst. Petrol. Rev.*, 1957, **11** (131), 304.—A review of the British Welding Research Assoc. and its lab is given. Welding research is carried out on brittle fracture, pressure vessels, welded tank opening, and fatigue. G. A. C.

405. The diatometer—a method for indicating conditions of aquatic life. M. H. Hohn. *Petrol. Engr*, 1957, **29** (2), C46–8.—River surveys have shown that the best measure of pollution is one based on the amount of diatoms present. The diatometer, which continually samples the diatom flora, was devised. E. A. G. H.

406. Eductor mixers for mixing liquids in fixed-roof tanks. R. B. Meny and R. B. Velykis. *Oil Gas J.*, 28.10.57, **55** (43), 88.—The device developed and patented by Socony Mobil Oil Co and used at the Paulsborough refinery is motivated by liq entering the tank with a submerged suction mixing device with the necessary aux connexions. Socony Mobil has decided to release the details. Basic information and procedure are given, including a standardized working drawing. G. A. C.

407. Titanium as a metal of construction for the chemical industry. E. Swainson. *Ingenieur, 's Grav.*, 12.6.57, **69** (28), Ch. 103–1.—Titanium is a newcomer to the family of constructional materials, but its output and uses are expanding rapidly. Ores are abundant, but production of metal is made difficult by high m.p. and affinity for atmospheric gases. TiO_2 is chlorinated to tetrachloride, from which the metal is obtained by reduction with Mg. Forming techniques are conventional. Density is 57% that of steel. Tensile strength ranges from 30 to 70 tons/sq in. Major use at present is in aircraft and aero engine construction. Resistance to corrosive attack makes it also suitable for applications in the chemical industry. Cost is high at present, but interest is increasing, and there is little doubt that overall economies can be obtained. 11 figs, 15 refs. G. F. T. C.

408. The use of tantalum and titanium for the construction of apparatus for the chemical plant. A. A. F. Lagerwey and C. G. van de Wateren. *Ingenieur, 's Grav.*, 2.8.57, **69** (31), Ch. 113–2.—Tantalum and titanium are expensive metals requiring special working techniques. They are used only where the use of other metals is uneconomic. Corrosion and cost data are given. Application in the construction of apparatus is discussed in some detail and illustrated by diagrams. Design methods are governed by the high price and the physical properties of both metals. Details are given of the construction of lined equipment, especially with regard to welding technique and liner fixing methods. A number of inherent problems are discussed. 11 figs. G. F. T. C.

DISTILLATION

409. Direct calculation of the number of theoretical plates. (In German). O. Thum. *Chem. Ing. Tech.*, 1957, **29**, 675–8.—The McCabe–Thiele diagram for the estimation of the number of theoretical plates required to separate a binary mixture in a dist column is easy to apply, but assumes equal heats of vaporization for the 2 components. In systems where the heats of vaporization are different, the graphical solution is usually complex, but a method has been derived for the solution of these problems in terms of the minimum number of plates at total reflux. P. J. K.

ABSORPTION AND ADSORPTION

410. Be careful scaling up gas absorption data. P. J. Hoftyzer. *Petrol. Refin.*, 1957, **36** (9), 275.—Gas absorption in some full-size columns may amount to only *ca* 25% of that predicted on the basis of pilot plant work. This article discusses some of the factors which cause the wide difference in scaling up, including liq flow and liq distribution in an irrigated packed column. J. R. T.

411. A new way to stability. Continuous percolation. C. D. Laughlin. *Petrol. Refin.*, 1957, **36** (9), 229–30.—A new continuous percolation method has been developed in order to overcome the high capital investment and idle equipment time inherent with static bed percolation. This process achieves countercurrent flow between oil and adsorbent, thus eliminating downtime and correspondingly decreasing equipment costs. A description of the process, with reference to percolator construction, is given and an economic evaluation included. J. R. T.

412. Continental Oil Co's Short Junction plant is a dual system plant. J. G. Reid. *Oil Gas J.*, 28.10.47, **43** (55), 113.—A combination refrigeration–oil absorption process cycle is employed at the new plant in Cleveland County, Oklahoma. Chilling is by ammonia refrigeration, and a high degree of flexibility is obtained by the process cycle. Flow diagrams are provided. G. A. C.

413. Natural-gas dehydration. A. G. Harrell. *Oil Gas J.*, 28.10.57, **43** (55), 121.—A natural gas stream of 950,000 M.c.f. is dehydrated from a water content of 7 lb/M M.c.f. to a bone-dry stream, and 260 tons of desiccant is used to prepare the gas stream for chilling to $-105°$ F. Daily liq recovery from the plant is 440,000 gal of ethane and heavier hydrocarbons. G. A. C.

SOLVENT EXTRACTION AND DEWAXING

414. How to size rotating disk contactors. G. H. Reman. *Petrol. Refin.*, 1957, **36** (9), 269–70.—Correlating formulæ for the design of a rotating disk contactor which describe the influence of the structural factors on capacity and efficiency are presented. Use of these formulæ reduces the amount of experimental data required to size commercial contactors. Necessary data was obtained, with standard test systems, in contactors ranging from 2 to 16 inches. Several methods of increasing both capacity and efficiency of contactors, indicated by this data, are outlined. J. R. T.

415. They use benzene–acetone to dewax. A. S. Konstas. *Petrol. Refin.*, 1957, **36**, (9), 241–2.—A description is given of a small dewaxing plant operating in Greece, where the

benzene–acetone process is used. Processing is done in 2 stages, both of which are described with the aid of flow diagrams. The pour point of the dewaxed oil is the same as the temp of filtration, and the waxes produced are practically free of oil. J. R. T.

CRACKING

416. Fluid catalyst design data. Pt 4. Nine variables in catalyst flow. F. A. Zenz. *Petrol. Refin.*, 1957, **36**, (7), 175–83.—The design of cat carrier lines is influenced by many variables. The study of 9 of these leads to the calculation of the saltation velocity or the pipe dia for a horizontal line carrying a mixed particle size cat. The author discusses the flow of cat through elbows, inclined pipes, and feed devices, and considers the effect of variables such as moisture content, pipe shape and roughness, and erosion. Charts and data are presented which implement the usual trial and error procedure. The design of particle feeders is considered in detail, and a sample calculation of the saltation velocity for a horizontal line carrying a material having a wide particle size distribution is included. J. R. T.

417. Winnie processing plant installs platformer. W. Downer. *Petrol. Engr*, 1957, **29** (2), C26–9.—Modification of an earlier unit with reactors containing platinum cat resulted in the production of 100 O.N. gasoline from naphtha. Plant operation is described in detail, and operating charts are provided. E. A. G. H.

418. Data on latest reforming process. P. H. Holt, II, and R. R. Haig. *Petrol. Refin.*, 1957, **36**, (9), 221–2.—The main features of the Esso Co's new Powerforming process for the production of high octane motor fuels are outlined. This is a fixed-bed cat process using a platinum cat which is regenerated periodically by a technique capable of maintaining very high activity. The cat regeneration facilities are designed to regenerate the cat in 16–24 hr. J. R. T.

419. Ultraforming to 100 octane number, clear. W. F. Johnston, W. J. Montgomery, and P. C. White. *Petrol. Engr*, 1957, **29** (2), C44–6.—The Ultraforming process operates at low pressure and uses a highly selective platinum cat which upgrades low O.N. naphtha to high octane gasoline. E. A. G. H.

420. Hydrocrack and gasify to upgrade stocks. E. B. Shultz, Jr., and H. R. Linden. *Petrol. Refin.*, 1957, **36** (9), 205–10.—The results of a study of hydrocracking and hydrogasification at 1500 p.s.i.g. are presented. These results indicate the feasibility of continuous conversion of dist oils and cat prehydrogenated residual oils to high methane content fuel gases and smaller amounts of liq products consisting primarily of aromatics in the gasoline boiling range. A detailed description of the pilot plant used for the tests is given. A literature review on hydrocracking and dearomatization is also included. J. R. T.

421. Now you can hydrocrack those asphaltic crudes. J. Varga *et al.* *Petrol. Refin.*, 1957, **36** (9), 198–200.—A description is given of a hydrocracking process for the production of motor fuels from high asphalt content crudes. The chief feature of this process is that these crudes, in admixture with a diluent, can be cracked continuously at relatively low pressures in the presence of hydrogen and suspended cat. Lab and pilot plant data are presented for the hydrocracking of a heavy Trans-Danubia crude. J. R. T.

422. Observation of promotors found in contact catalysts. Anon. *J. Coll. Sci.*, 1957, **12** (3), 263–6.—It is demonstrated by means of electron diffraction at 50 kV and 200 kV that the promotor phase (MgO or NiO) predominates over the cat substrate phase (Cu) in the surface of the contact cat. (Author's abstract.)

423. Expansion at Höchst Petrochemicals. (In German.) Anon. *Chem. Industrie*, 1957, **9**, 503.—Farbe Werke Höchst AG are erecting a new plant for cracking light naphtha in order to increase production of olefins. More propylene for the manufacture of polypropylene will be made. P. J. K.

424. Now—petrochemicals from resid. S. Tsutsumi. *Petrol. Refin.*, 1957, **36** (9), 287–9.—A description is given of a new moving bed cat cracking process for the production of an olefin rich gas from oil. Several applications of these cracked gases to petrochemical manufacture are described and include production of aromatic hydrocarbons, production of cumene and separation of ethylene, and the synthesis of terephthalic acid and *p*-cresol. Data are presented showing the products of kerosine cracking by this process. J. R. T.

HYDROGENATION

425. This new process handles residuals. H. Pichler *et al.* *Petrol. Refin.*, 1957, **36** (9), 201–4.—A description is given of the new " H-oil " process for the reduction of refinery heavy residual stocks to the plant fuel requirement and conversion of the remainder to valuable dist products. The effect of several process variables is discussed, and data are presented for the processing of 8° API Kuwait residuum and a blend of heavy non-residuum stocks consisting of furfural extract and TCC synthetic tower bottoms. The results of an economic study of 2 H-oil plants designed for throughputs of 14,000 b.s.d. and 5000 b.s.d. are also discussed. J. R. T.

POLYMERIZATION

426. Isotactic polymers. G. Natta. *Chem. & Ind.*, 1957, 1520–30.—*Cf* Abs. **1796**, 1957.

ALKYLATION

427. How to treat alkylate. V. L. Brant. *Petrol. Refin.*, 1957, **36** (9), 226–8.—D-X Sunray Oil Co have replaced caustic washing with bauxite filters to reduce fouling and corrosion in their sulphuric acid alkylation plants. The treating system is described in detail and the main improvements outlined. Reduction in maintenance and down-time, due to fouling, with the new system, has been estimated as 85%, with resultant large savings. J. R. T.

ISOMERIZATION

428. The new look in butane isomerization. J. A. Samaniego. *Petrol. Refin.*, 1957, **36** (9), 223–5.—This article outlines the changes made in the Shell liq phase isomerization process for the production of *iso*butane. The principal difference in the new process is the use of 3 reactor vessels connected in series instead of a single vessel. This modification significantly improves the approach to equilibrium, and hence the conversion per pass. A detailed flowsheet of the process is presented, and a typical overall material balance for operation with a 2-stage reactor given. J. R. T.

429. Isomerization process gives high road octanes. E. F. Schwarzenbek. *Petrol. Refin.*, 1957, **36** (9), 215–20.—The new Iso-Kel process for the production of high octane motor fuels by isomerization of pentanes and hexanes is described. The process employs a precious metal cat (non-platinum) and, in general, is operated in the same pressure range as conventional cat reforming, but at lower gas recycle rates and higher

space velocities. Data are presented for the isomerization of several commercial feedstocks, and the economics of the isomerization of pentanes and hexanes from Kuwait crude discussed. The results of road performance tests on the products of this process are given, and a comparison is made of blends containing light cat cracked gasoline and isomerized pentanes and hexanes respectively. J. R. T.

430. Newest pentane–hexane isomerization process. Anon. *Petrol. Engr*, 1957, **29** (2), C10–11.—A cat process to upgrade mixtures of pentane and hexane to higher O.N. isomers is outlined. E. A. G. H.

CHEMICAL AND PHYSICAL REFINING

431. Try this new way to get oil-free wax. W. Fischer. *Petrol. Refin.*, 1957, **36** (9), 236–8.—A new process developed by the Edeleanu Co, called Spray De-oiling, is described. The process produces an oil-free wax by forming small wax particles within a stream of air and then dissolving the resulting oil film from the particles. Dichloroethane has been used successfully as an oil solvent, as its favourable b.p. ensures low vapour pressures in the various operations. The main advantages of this new process are discussed, and the results of de-oiling 2 crude waxes of different origin are presented. J. R. T.

432. Hydrogen treating helps wide range of stocks. L. E. Carlsmith and R. R. Haig. *Petrol. Refin.*, 1957, **36** (9), 233–5.—The continued demand for better product quality has stimulated the use of cat processes for hydrogen treating. This article briefly describes the Hydrofining process and presents the results of its application to a wide range of petroleum stocks, including naphthas, heating oils, solvents, cat cracking feed, and lub oils. J. R. T.

SPECIAL PROCESSES

433. Chinese advances in the synthesis of liquid fuels. C. Ta-Yu, L. Nan-Tsuen, and C. Chun-Hao. *Chem. Proc. Engng*, 1957, **38**, 403–7.—Studies of the synthesis of liq fuels from CO and H_2 using a fluidized cat technique have been carried out at the Chinese IP. Nitrided Fe cat were used, and the effects of variables on product yield and composition were investigated. Results on 2 and 30 l cat capacity units are tabulated, and some relationships are established. The complex mixture of products was analysed by gas chromatography (Janák method), Orsat apparatus, and other chem methods. Some investigations using Co cat have also taken place. W. A. M.

434. Manufacture of catalysts at Clitheroe. Anon. *Petrol. Times*, 25.10.57, **61** (1571), 961.—The extension to the Billingham Division of the ICI Ltd plant at Clitheroe consists of buildings, housing, oven section for drying, decomposition calcination, etc., and pelleting section for dry processing. Future facilities to be provided include a pilot manufacturing unit to be used in scaling-up of cat preparations from a bench scale to full commercial production. G. A. C.

435. Fluid coking shifts product distribution. R. M. Cornforth. *Petrol. Refin.*, 1957, **36** (9), 211–14.—The decreasing demand for residual fuel oil has introduced the need for new refinery processes to increase the yield of gas oil at the expense of fuel oil. The fluid coking process has been developed to produce max reduction in residual fuel oil yield. A description of this process is given and its main advantages outlined. Applications of the by-product coke produced in the process are discussed, and include its use as a fuel and as carbon electrodes for the aluminium industry. J. R. T.

METERING AND CONTROL

436. Computers shorten refinery planning time. R. G. Donovan and R. W. Schrage. *Petrol. Engr*, 1957, **29** (2), C32–4.—A complete refinery can be simulated on a large-scale computer, which finds a manner for operating the refinery so that physical limitations and quality requirements are satisfied. E. A. G. H.

437. How the mass spectrometer functions in plant and production control. H. Landsberg. *Oil Gas J.*, 21.10.57, **55** (42), 103.—Applications include petroleum production, sulphur recovery pilot-plant studies, selective absorption, and ammonia production. Charts illustrate uses. G. A. C.

438. Automatic stream analysers. D. J. Fraade. *Oil Gas J.*, 21.10.57, **55** (42), 93.—Types of stream analysers for monitoring operations and detecting changes in continuous processes are discussed, and include mass spectrometers, i.r. positive non-dispersive type, refractometers, viscometers, and gas chromatographers. Dist, conversion purification, and blending operations can all utilize the control techniques. G. A. C.

439. Control and measurement of viscosity. Anon. *Petrol. Times*, 8.11.57, **61** (1572), 999.—Details are given of a new viscometer and controller produced by International Combustion Ltd for use in oil firing, and which employs a constant pressure differential system. G. A. C.

440. Orifice-meter maintenance. D. D. Koepfe. *Insts & Automation*, 1957, **30** (6), 1132.—Maintenance of an orifice meter is a common problem and requires a little care, if it is to be of any importance. First, the problem involved must be fully understood, then a routine number of check steps must be carried out, to cover the instrument zero, mercury level, leaks, calibration, and controller action. M. J. R.

441. Industrial application of potentiometry. (In German.) C. L. Gauchat. *Chem. Ing. Tech.*, 1957, **29**, 701–8.—Measurement of pH value, Redox potential, etc., by potentiometry is a well-understood lab technique. The application to industrial installations is comparatively recent, and the problems involved are discussed. Several examples are given from actual practice. P. J. K.

442. Valve pressure-drop nomograph. D. S. Davis. *Insts & Automation*, 1957, **30** (1), 73.—The nomograph presented can be used to predict the pressure-drop, for liq, across parabolic plug valves. M. J. R.

443. Level regulators. C. S. Beard. *Insts & Automation*, 1957, **30**, (9), 1693.—The commonest and simplest type of level controller is a float-operated valve, and this type of instrument is described in some detail, together with factors affecting the choice of a suitable float. Mention is also made of other types of regulators which use displacement technique, or the thermal expansion of liq or metals to actuate a valve. M. J. R.

444. Temperature regulators. C. S. Beard. *Insts & Automation*, 1957, **30** (8), 1479.—Temp regulation generally is accomplished by controlling the flow of the heat transfer medium. Therefore, most temp regulators are control valves with temp-sensing devices which either alter the position of the valve directly, or via a relay. A detailed description of a number of these temp-sensitive devices is given, and how they are used in conjunction with the valves controlling the heat transfer medium. Combined pressure–temp regulators are also discussed in the article. M. J. R.

445. Pressure regulators. C. S. Beard. *Insts & Automation*, 1957, **30** (7), 1293.—This is the third article by the author on pressure regulators, and contains a description of equipment not previously mentioned. This includes regulators for back pressure, vacuum, flow, and discharge control. M. J. R.

446. Pneumatically loaded regulators. C. S. Beard. *Insts & Automation*, 1957, **30** (6), 1091.—Pneumatic loading of a regulator provides increased flexibility and versatility, both of which can be further increased by the use of pilots, and combinations of mechanical and pneumatic techniques. The article contains a survey of all these types of regulator, together with the underlying theory. M. J. R.

447. Mechanically-loaded pressure regulators. C. S. Beard. *Insts & Automation*, 1957, **30** (5), 876.—The types of regulator described are those using weights and springs for loading. A comprehensive treatment of the theory is also given for equipment incorporating such features. M. J. R.

448. Continuous gravimetric proportioning. R. P. Lowe. *Insts & Automation*, 1957, **30** (3), 482.—The article discusses the requirements for the application of gravimetric proportioning systems, namely, load-detecting and supporting means, load reducing and transmitting devices, counterbalancing elements, and control methods. Systems include loss-in-weight type, gravimetric belt feeders, and conveyor scales, all being illustrated with reference to industrial plant in present-day use. M. J. R.

449. New developments in area meters. G. H. Seemar. *Insts & Automation*, 1957, **30** (2), 256–7.—Refinements in production technique, such as ultrasonic impact grinding, precision bore tubing, and careful surface finishing make possible reproducible orifices. Applying these modern ideas should bring about a wider acceptance of " variable-port " measurement, which has previously been discarded in favour of the other type of variable-area meter, namely the rotameter. M. J. R.

PRODUCTS

CHEMISTRY AND PHYSICS

450. Predicting *V–L* equilibrium data. L. N. Canjar *et al.* *Petrol. Refin.*, 1957, **36** (9), 291–5.—The 3 principal methods of predicting vapour–liq equilibrium data, namely, the activity coeff method, the equation of state, and the convergence pressure method, are discussed, and their main weaknesses outlined. A method of treating experimental vapour–liq data based on the activity coeff approach is presented. This method has several advantages in that it is simple in form, containing no arbitrary constants, it is completely analytical, using temp and pressure as independent variables, and it facilitates the estimation of related p–v–t and thermodynamic properties for process calc. J. R. T.

ANALYSIS AND TESTING

451. Analytical methods—accurate sampling. D. Vandy. *Petrol. Engr*, 1957, **29** (2), C18–23.—Attention to detail in technique, analysis of the problem to determine the required samples and sampling points, and correct procedure are needed to obtain representative samples. E. A. G. H.

452. Gas–liquid partition chromatography of mixtures of the three isomeric methyl*cyclo*hexenes and methylene*cyclo*hexane. E. Gil-Av, J. Herling, and J. Shabtai. *Chem. & Ind.*, 1957, 1483–4.—Mixtures of 1-, 3-, and 4-methyl*cyclo*hexene and methylene*cyclo*hexane were quant analysed by GLPC using 1 part of saturated $AgNO_3$/glycol soln supported on 2 parts of Sterchamol 50–80 mesh. Operating conditions and relative retention vol are given. W. A. M.

453. Systematic analysis of deposits from oil-fired furnaces. J. W. McCoy. *Bull. Amer. Soc. Test. Mat.*, 1957, (221), 59–63.—The importance of deposit analysis in the investigation of deposit formation in furnaces fired with residual fuel oil is emphasized and preliminary treatment of lab samples described, followed by a scheme of analysis for the determination of iron, aluminium, vanadium, lead, nickel, calcium, magnesium, sodium, silicon, sulphur, and carbon using less than 2 g of the extracted residue. J. G. H.

454. Methods of testing carbon black. ASTM Cttee D-24 on Carbon Black. *Bull. Amer. Soc. Test. Mat.*, 1957, (215), 51–8.—Test methods for pellet size distribution, solvent-extractable material, attrition of pelleted carbon black, degree of discoloration of benzene by carbon black, amount of fines in pelleted material, heating loss, power density, volatile and ash content, and mass strength are presented. J. G. H.

455. Comparison of viscosity-index proposals. J. C. Geniesse. *Bull. Amer. Soc. Test. Mat.*, 1956, (215), 81–4.—The basis of the ASTM viscosity index as promulgated by Dean and Davis is briefly summarized, and the suggested modifications of Blott and Verver, Herse, Fisher and Fenske, Malschaert, and of Larsen and Schwaderer, together with the proposals of Hardiman and Nissan, Klaus and Fenske, Wright, Ramser, and Cornelissen and Waterman are presented and illustrated. 10 refs. J. G. H.

456. Measuring the abrasiveness of carbonaceous deposits. Anon. *Sci. Lubric.*, 1957, **9** (7), 16–17.—Details are presented of a machine designed at the BICERA lab for comparing the abrasiveness of fuel deposits. Operation is based on the loss of weight of standard metal disks exposed to the abrasive action of samples of the carbonaceous deposits. Collection of deposits, operation of the machine, interpretation of results, and possible applications are described. J. G. H.

457. Statistical quality control in a petroleum control laboratory. J. M. Duncan. *Bull. Amer. Soc. Test. Mat.*, 1957, (219), 40–3.—The purpose of statistical quality control in a petroleum control lab is briefly indicated, and such a system, comprising a reference sample programme and a check test programme, is described in some detail. The application of data so obtained to the improvement of test methods is discussed, and further statistical applications are suggested. J. G. H.

458. Viscosity of bituminous materials. (In German.) H. Walther. *Bitumen, Teere, Asphalte, Peche*, 1957, **8** (2), 46–53.—Flow curves—the basis of abs visc evaluation—are discussed in relation to the informatory thermodynamic and structural deductions derivable, in certain circumstances, from their form and position. Investigations and observations are presented—with supporting curves—on visc measurements as a general physical measuring principle in production and approval control of bituminous materials. Results of measurements on selected representative groups of bituminous materials show the decisive influence, both of the chem nature of the raw materials used and the production technique on visc, for the shaping and working eff of the final product. However, they permit recognition that better knowledge of the visc pattern under the influence of ext

factors—temp, magnitude, and action rate of deforming mechanical forces and time—can disclose possibilities for improving and adjusting material properties to process technique and intended use, which estimation of chem composition does not offer. With colloids like the bituminous materials treated here, together with their chem structure, the physical condition of dispersion plays a decisive role. R. T.

459. Automatic Oswald viscometer. G. Goldfinger and W. Greatbatch. *Insts & Automation*, 1957, **30** (1), 88.—The authors have evolved a system whereby an Oswald viscometer can be made automatic. This is done electronically with phototransistors, which are used to operate the clutch of an electronic timing device. M. J. R.

460. CSMA adopts tentative dishwashing detergent tests. Anon. *Soap, N.Y.*, Sept. 1957, **33** (9), 60.—2 tentative test methods for dishwashing detergents were accepted by the Soap, Detergents, and Sanitary Chemical Products Division of Chemical Specialties Manufacture Association, U.S.A., in May 1957. The overglaze removal test and the spotting and filming test in home dishwashing machines are described. G. A. C.

GAS

461. Natural gas processing by low temperature separation. J. L. Wiggins. *Petrol. Engr*, 1957, **29** (2), B65–73.—2 typical processes are described for purifying natural gas. The first process reduces the pressure of the gas and separates out hydrates and liq in a refrigerating tank. Recently an improved method of separation using glycol to inhibit hydrate formation has been developed. E. A. G. H.

462. Gas production on Utah's Wasatch plateau. C. R. Graham. *Petrol. Engr*, 1957, **29** (1), B53–60.—Problems of obtaining natural gas from a remote mountainous site are set out. E. A. G. H.

463. Possible influence of Lacq natural gas on development of mining industry in SW. France. V. Charrin. *Chim. et Industr.*, 1957, **78**, 288–95.—Review, with particular reference to possible use of gas for reduction of iron ores. Use of gas in other mining applications would be as for fuel or power, in a region where other fuel sources are scarce. S potentialities of Lacq gas make re-opening of S mines, or search for pyrites deposits, unattractive. V. B.

ENGINE FUELS

464. Applications of an enthalpy–fuel/air ratio diagram to "first law" combustion problems. H. N. Powell. *Trans. Amer. Soc. Mech. Engrs*, 1957, **79** (5), 1129–41.—The term "absolute enthalpy" is defined, and used to prepare an enthalpy–fuel/air ratio diagram for combustion gases in equilibrium. This diagram provides solutions to problems involving the determination of adiabatic flame temp, theoretical heat release, combustion efficiencies (from experimental temp measurements), and the adiabatic mixing of 2 streams. The absolute enthalpy and heat capacity for $(CH_2)_y$–air and $(CH_3)_y$–air systems are tabulated. 8 refs. C. B.

465. Doctor-air-caustic sweetening of inhibited gasoline. L. D. Rompino and M. J. Gorham. *Petrol. Engr*, 1957, **29** (2), C12–14.—The speed of sweetening light cat naphtha is accelerated and the gum content reduced, if a small amount of doctor soln is added to the caustic sweetening soln. Consumption of inhibitor and TEL is reduced. E. A. G. H.

466. How refiners make hi-octane gasoline. T. W. Warren and R. C. Kersten. *Petrol. Engr*, 1957, **29** (2), E8–10.—Various methods of improving the octane rating of gasoline are reviewed, including TEL addition, cat and thermal reforming, polymerization, alkylation, and isomerization. Careful economic analysis is needed to combine these processes for the achievement of max high octane production at lowest possible cost. E. A. G. H.

LUBRICANTS

467. Laboratory evaluation of the resistance to oxidation of "R and O" industrial oils. W. C. Milz and E. M. Kipp. *Lubric. Engng*, 1956, **12** (6), 396–400.—Apparatus and procedure employed in the Alcoa Oxygen Absorption Test and the ASTM D-943 Turbine Oil Stability Test for the oxidn stability testing of R and O circulating system oils are described and illustrated. Results obtained in the 2 tests showed good correlation, and as the Alcoa test runs for 75 hr, as compared with 500 hr for ASTM D-943, there would appear to be good grounds for using the Alcoa test for screening purposes. J. G. H.

468. Grinding temperatures. J. E. Mayer and M. C. Shaw. *Lubric. Engng*, 1957, **13** (1), 21–7.—Previous methods of measuring grinding temp are outlined, and it is considered that the temp at the surface during grinding is of major significance in the study of wheel wear and of formation of surface cracks in a hardened workpiece during grinding. Details and illustrations of a lead sulphide cell circuit used in conjunction with an oscilloscope are presented, and the procedure employed in the use of this unit to measure surface temp is described. Interpretation of results so obtained is explained, and data obtained with various grinding fluids is presented and discussed. 21 refs. J. G. H.

469. Chemical composition of lubricating oils, cutting oils, and petroleum solvents. W. C. Witham. *Lubric. Engng*, 1957, **13** (2), 83–4.—The chemical composition of straight and soluble oils as cutting fluids, lub oils, and solvents is briefly discussed. J. G. H.

470. Surface viscosity and elasticity of lubricating oils. D. W. Criddle. *Lubric. Engng*, 1957, **13** (3), 131–5.—The importance of surface properties in relation to foaming, emulsification, and boundary lubrication is discussed, and the use of sorbitan sesquioleate as an additive for the promotion of increased visc at oil–water interfaces is remarked. Details are presented of a method for the measurement of surface visc by means of a torsion pendulum viscometer which is described and illustrated. J. G. H.

471. Use of an automatic viscometer for the study of lubricant flow. R. N. Weltmann and P. W. Kuhns. *Lubric. Engng*, 1957, **13** (1), 43–50.—Data on flow properties and mechanism of flow process of lubricants is essential for study of lubrication problems. Details are presented of the design and operation of automatic concentric-cylinder rotational viscometer built at the NACA Lewis Flight Propulsion Lab. Flow curves so obtained and properties derived therefrom for a diester oil and 2 aircraft greases are illustrated and discussed, and application of data so obtained to solution of pipeline problems is considered. J. G. H.

472. Disinfection of soluble oil emulsions. H. Pivnick and C. K. Fotopoulos. *Lubric. Engng*, 1957, **13** (3), 151–6.—Soluble oils used as cutting fluids when dispersed in water readily support bacterial growth, which gives rise to a number of deleterious conditions. Bacterial control has been attempted by various methods which have not proved wholly adequate. Of these chemical disinfection appears to offer several advantages, yet leaves much to be desired. Current investigation showed wide variations in practice in concn of disinfectant and in stage of application, whether in original concentrate or

in diluted product. Results obtained indicate need for more extensive investigation of relative effectiveness of various disinfectants used, and of bacterial activity in emulsions. Emphasis is also laid on the necessity for thorough cleanliness. J. G. H.

473. Study of new and regenerated motor oil. A. B. Stern. *Sci. Lubric.*, 1957, **9** (8), 16–20.—Details are presented of an investigation reported to the Research Council of Israel on the comparative performance of new and regenerated crankcase oils. Ford F.1. 6-cyl trucks, operating on 70 O.N. gasoline, were used and the MIL-O-2104 specification was used as a basis for comparison. Engine and inspection tests revealed that H.D. crankcase oils when regenerated and treated with suitable H.D. additives gave results practically equal to new oils. J. G. H.

474. Molybdenum disulphide as a grease additive. E. E. Smith. *NLGI Spokesm.*, 1956, **20** (9), 20–36.—The lubricating properties of molybdenum disulphide are outlined, and its special functions as a grease additive are indicated, with particular reference to its tendency to deposit out of greases on to metal surfaces to form durable low friction films. Variables affecting performance of molybdenum disulphide in greases, including type of soap, additive concn, visc of contained oil, and additive particle size, are discussed in some detail. Appendices set out detailed procedures for grease performance tests. J. G. H.

475. Lubrication of friction drives. T. B. Lane. *Lubric. Engng*, 1957, **13** (2), 85–8.—Extended applications of friction drives and the necessity of lubricants giving a high coeff of friction resulted in the development of a modified 2-ball machine which was used in the investigation of the effect of lubricants on the friction coeff here reported. The equipment and procedure used are described in some detail. Results so obtained indicate that the temp coeff of visc of the lubricant is a significant factor in friction drive efficiency, a large value being beneficial. J. G. H.

476. Equilibrium distribution of transfer fragments. E. Rabinowicz. *Lubric. Engng*, 1956, **12** (6), 401–4.—A mathematical treatment of the phenomena occurring when 2 dissimilar metals slide one upon the other, resulting in fragmentation and surface transfer. Equilibrium equations are presented for fragments held loosely and tightly, and rate of transfer is shown to be inversely proportional to the sliding area. J. G. H.

477. Analysis of orifice and capillary-compared hydrostatic journal bearings. A. A. Raimondi and J. Boyd. *Lubric. Engng*, 1957, **13** (1), 28–37.—The desirable characteristics of compensated hydrostatic journal bearings are remarked, as is also present lack of analytical and experimental data on this type of bearing—a deficiency which this paper attempts to make good. Data on types of loading and principles of operation are followed by a detailed theoretical analysis and a comparison of data so derived with that obtained from actual tests. J. G. H.

478. Assessment of automobile bearing performance from field tests. P. G. Forrester and W. E. Duckworth. *Lubric. Engng*, 1957, **13** (1), 38–42.—Conditions encountered by bearings in service present so many variables as to render their simulation in lab tests impracticable. In the same way data from general service experience are difficult to obtain and are frequently unreliable. Details are presented of a programme of controlled service tests in which test bearings are fitted in standard vehicle engines operating under normal conditions. Test procedures used and methods for measurement of wear on bearings and crankshafts are described in some detail, and the influence of dust and significance of variations between vehicles discussed. J. G. H.

479. New Orobis additive plant. Anon. *Sci. Lubric.*, 1957, **9** (6), 20–3.—Development of lub oil additives industry is sketched, and the manufacturing plant at Hull of Orobis Ltd (Oronite Chemicals–Distillers Co) is briefly described, with details of engine test facilities. J. G. H.

480. Use of rolling contact bearings in low viscosity liquid metal lubricants. W. Markert, Jr., and K. M. Ferguson. *Lubric. Engng*, 1957, **13** (5), 285–90.—Use of liq metals as heat transfer fluids in power plants results in special lubrication problems attendant on higher temp and sealed mechanical systems. Bearing lubricant conditions have been investigated under these conditions, employing the heat transfer fluid as lubricant. Procedure and equipment employed is described and illustrated. Main cause of bearing failure appeared to be metallic retainer, which introduced foreign material into system. Use of non-metallic retainers with sodium–potassium lubrication resulted in a reasonable life for ball bearings. J. G. H.

481. Effects of nuclear radiation on lubricants. J. A. King and W. L. R. Rice. *Lubric. Engng*, 1957, **13** (5), 279–83.—Details are presented of an investigation of the effects of γ radiations of the order 1×10^8 roentgens/hr on specification type greases, lub oils, and hydraulic fluids of conventional and synthetic types. Only significant effect noted on greases was decrease in penetration. Lub oils and hydraulic fluids showed marked deterioration in visc and oxidn corrosion characteristics on exposure to radiation, with appreciable variations between conventional and synthetic products. Need for much more detailed investigation in order to obtain adequate data is stressed. J. G. H.

482. Studies of formation and behaviour of an extreme-pressure film. V. N. Borsoff and C. D. Wagner. *Lubric. Engng*, 1957, **13** (2), 91–9.—Earlier studies have explained E.P. action as resulting from the formation of protective films on the rubbing surfaces. In the present investigation gears lubricated with a mineral oil compounded with dibenzyl-disulphide containing radioactive sulphur were operated in a spur gear (four-square) machine under controlled conditions. The gears were then tested for radioactivity as a measure of film deposition, both generally and locally. Methods, safety precautions, and results obtained are reported and lead to conclusions that thickness of iron-sulphide films formed on working surfaces of gear teeth increases directly with load and is little affected by time: thickness of film is minimum at pitch circle and gradually increases towards addendum and dedendum, indicating that film thickness is controlled by contact temp; a thinner and more uniform film forms on idle side of gear tooth; an appropriate steady state thickness of E.P. film is established for each operating condition. The iron surface was found to react with the dibenzyl sulphide at a temp-dependent rate; there was little such reaction with the inoperative parts of the gear. J. G. H.

483. Mechanism of "free" rolling friction. D. Tabor. *Lubric. Engng*, 1956, **12** (6), 379–86.—A theoretical and mathematical treatment covering rolling in the plastic range, rolling of cyl in the elastic range, rolling of sphere on flat rubber, differential slip in rolling, rolling of a steel sphere in a metal groove, and rolling of spheres on spheres. Previous work on elastic hysteresis resistance is noted in the discussion. J. G. H.

484. Concentration effects of cutting oil additives in performance evaluation. A. Dorinson. *Lubric. Engng*, 1956, **12** (6), 387–91.—Details are reported of an investigation of relations between additive concn and performance of cutting oils based

on turning, planing, and tapping tests. From the data obtained a hypothesis is developed which correlates additive concn with surface finish up to a point of max effectiveness. The necessity for the chemistry of additive action keeping pace with fundamental physics of metal cutting is emphasized. J. G. H.

485. Radiation-resistant greases. J. G. Carrol, R. O. Bolt, and B. W. Hotten. *Lubric. Engng*, 1957, **13** (3), 136–40.—Increasing applications of nuclear radiation have resulted in additional requirements in lubricants exposed thereto. Present paper reports results of an investigation to observe some effects of radiation on present commercial grease types and to develop greases having improved radiation resistance. Greases were exposed to pile irradiations and also to γ radiations, as the latter were considered to predominate in most applications calling for radiation-resistant lubricants. Exposure to pile irradiation resulted in deterioration to a brittle porous solid. Greases exposed to γ radiations experienced an initial softening, followed by eventual hardening; bearing life, oxidation stability, and low temp torque were all impaired. Greases made from alkylaromatic fluids and selected gelling agents proved most satisfactory, with alkylbenzenes inhibited with organic selenides and gelled with Estersil showing good anti-hardening properties. J. G. H.

486. Lubrication problems at nuclear power stations. L. A. Cooper and B. R. Davies. *Sci. Lubric.*, 1957, **9** (8), 31–5, 39.—The basic principles of nuclear power generation are outlined, and the effects of radiations on lub oil are indicated, these mainly resulting in increased visc due to polymerization. Mechanical equipment which is remote from the reactor can be adequately served by conventional lubricants. Lubricants for blower equipment for gas circulation call for low vapour pressure and the absence of metallic additives. Reactor lubrication is best effected by aromatic-rich hydrocarbons. Work is also under way on possible synthetics for this purpose. J. G. H.

487. Effect of oxygen concentration in atmosphere on oil lubrication of high-temperature ball bearings. Z. N. Nemeth and W. J. Anderson. *Lubric. Engng*, 1956, **12** (5), 327–30.—Details are presented of an investigation of the operation of ball bearings at temp up to 850° F lubricated with 1010 turbine oil with an ambient atmosphere consisting of air–nitrogen mixtures of various ratios. The bearing rig built round a floor-type drill press is described and illustrated. Solid molybdenum disulphide was tried as lubricant, but deteriorated to abrasive oxidn products. The useful life of liq lubricants was found to be lengthened by the exclusion of oxygen from the atmosphere surrounding the bearing; effective oil lubrication was found to require an amount of oil in excess of that removed by evaporation, thermal decomposition, and oxidn. 14 refs. J. G. H.

488. Cutting fluid evaluation. H. W. Husa. *Trans. Amer. Soc. Mech. Engrs*, 1957, **79** (5), 1172–6.—The various methods of evaluating cutting fluids are discussed, and a radioactive tracer technique for measuring cutting tool wear rate is described. In conjunction with measurements of surface roughness and of cutting temp, the method is found to give an accurate indication of cutting fluid performance. Compounded and mineral oils are compared in the machining of 1015 and 1045 steels. 2 refs. C. B.

489. On the theory of grease-lubricated thrust bearings. A. Slibar and P. R. Pasley. *Trans. Amer. Soc. Mech. Engrs*, 1957, **79** (6), 1229–34.—The paper considers the 3-dimensional steady state of a grease lubricated rotating thrust bearing. After derivation of a stress-deformation rate relation for the grease, a solution for the steady state is found using characteristic parameters and a perturbation procedure. Curves are given and examples worked out for the solution of design problems in the grease lubrication of rotating thrust bearings. 7 refs. C. B.

490. Heat transfer effects in hydrostatic thrust bearing lubrication. W. H. Hughes and J. F. Osterle. *Trans. Amer. Soc. Mech. Engrs*, 1957, **79** (6), 1225–8.—Operating conditions in a hydrostatic thrust bearing are considered for the period when heat transfer occurs in the lubricant and bearings. Assuming the bearings to be much smaller than its mountings, housing, and foundation, the temp and pressure distribution and frictional torque are investigated. Results are compared with those derived from isothermal and adiabatic considerations for an incompressible lubricant such as oil, and a compressible lubricant such as air. 6 refs. C. B.

491. Oil cooling and oil coolers. 3. Control valves and air cooled oil coolers. G. A. Montgomerie. *Sci. Lubric.*, 1957, **9** (5), 10–14.—Thermostatic and manual valves are described and illustrated, together with the Serck range of air coolers. J. G. H.

492. Lubricating oils: properties and applications. Chap. XIV. V. A. Kalichevsky. *Petrol. Engr*, 1957, **29** (1), C14–17.—The properties of visc, V.I., pour point, stability, and adhesive powers provide a measure of the suitability of a lubricant for various applications. E. A. G. H.

493. Conference on Lubrication and Wear. Pt 1. R. Tourret. *Petrol. Times*, 25.10.57, **61** (1571), 964.—Titles and summaries of 38 of the 104 papers presented at the conference of Institution of Mechanical Engrs, Oct. 1957. G. A. C.

BITUMEN, ASPHALT, AND TAR

494. Bitumen emulsions—recent advances in knowledge of their properties. Pt 3. (In German.) H. Nüssel and A. Buhs. *Bitumen, Teere, Asphalte, Peche*, 1957, **8** (1), 15–17.—The smallest deviations in composition, small changes in production procedure or in the properties of the material—often unavoidable in tech operations—require constant adjustment to stipulated conditions. Factors influencing the properties of semi-stable and unstable emulsions are discussed. The compiled results of experiments indicate adjustments necessary to meet tech requirements. Desired properties of emulsions can be regulated within the scope generally possible, to meet users' requirements. Numerous charts and tables are presented. R. T.

495. Investigations on artificial ageing of bituminous binders and the relations to the properties of their films. (In German.) K. Letters. *Bitumen, Teere, Asphalte, Peche*, 1957, **8** (1), 3–8; **8** (2), 37–41.—Pt 1. The author's previous work on tar and bitumen films 1μ ($1 \cdot 10^{-4}$ cm) thick on H_2O is followed up by tests on films 0·1 mm ($1 \cdot 0^{-2}$ cm) thick on glass. The periodical course of artificial ageing is observed on 16 road tar and bitumen samples. Results of the test series in 3 alternating variables—water storage, u.v. irradiation, heating to 50° C and cooling to −20° C—are presented in detail for individual materials with supporting photographs. Visual observation indicates surface changes. Scratch tests give an estimate of crack and pit formation, depth effects, progress of hardening or oil separation, and changes in adhesion to the glass. Road tars show surface changes with crack formation generally earlier than bitumen, especially with longer water stressing and show generally some contraction tendency.

Bitumen–tar mixtures have higher plasticity, better adhesive power, and smaller tendency to crystallization, advantages are only effective in weak solar irradiation. In tar–bitumen mixtures with small tar additions thick films give retarded ageing with low strengths. 10 literature refs. Pt 2. Results of further experiments—supported by photographs—show that surface changes with crack formation do not occur with bitumen as rapidly as with tar under long water and heat stressing. In the later stage of stressing the picture is reversed in so far as an intensified surface change with formation of bright hardened islands and broad oily canals—with decrease of adhesive power after water storage—appear. R. T.

496. Asphalt research at the National Bureau of Standards. H. R. Snoke. *Bull. Amer. Soc. Test. Mat.*, 1957, (220), 41–3.—Asphalt research at the National Bureau of Standards from the early 1920s, covering roofing products, additives, and photo-oxidation degradation is briefly reviewed. 13 refs. J. G. H.

497. Water-soluble degradation products of asphalt. A. Schriesheim and S. H. Greenfield. *Bull. Amer. Soc. Test. Mat.*, 1957, (220), 43–7.—The exposure of asphalt to oxygen and light results in the formation of water-soluble degradation products which are more easily analysed than the asphalt itself. Preliminary findings of an investigation of these degradation products formed in the interval between 550 and 850 hr exposure in an accelerated weathering machine, using chemical, spectrographic, and exchange resin techniques are reported and future work indicated. 18 refs. J. G. H.

498. Asphalt roofings. (In German.) A. W. Rick. *Bitumen, Teere, Asphalte, Peche*, 1957, **8** (1), 20–2.—In asphalt roofings visible joints are to be avoided; waterproof and easily repaired roofs are essential. Crack formation may result from laying areas too big, causing joint failures, inadequate separation from the base, use of bitumen too hard or too soft, or excessive in relation to additions, surface bitumen enrichment, unsuitable additions, and wrong working sequence. To avoid cracks poured asphalt mixtures should not be fatter than absolutely necessary, binders neither too soft nor too hard, and adjusted to the requirements of the additions. It is essential to observe possible movements of the base and the asphalt surface itself, and to consider cooling stresses when laying roofings. R. T.

499. Viscoelastic properties of a high consistency asphalt. A. B. Brown, J. W. Sparks, and F. M. Smith. *J. Coll. Sci.*, 1957, **12** (3), 283–93.—High-consistency asphalts behave, rheologically, in the complex viscoelastic pattern common to many macromolecular species such as synthetic plastics and elastomers. A correlation with accepted linear viscoelastic theory has been developed for the behaviour pattern, under tensile test conditions, of a typical, hard asphalt in creep, creep recovery, and stress relaxation. The same simple viscous and elastic moduli are found to determine these several action modes. The range and magnitude of discrete moduli have been determined from the empirical creep time and creep recovery time relations. Calculated values of stress relaxation, based on these moduli derived from creep and creep recovery, compare favourably with direct experiment. (Author's abstract.)

SPECIAL HYDROCARBON PRODUCTS

500. Conditioning transformer oil on site. Anon. *Elect. Times*, 1957, **132**, 829.—Brief description (photo) of mobile unit (1100 gal/hr) comprising coarse filter, oil heater, filter press, spraying tank, and necessary pumps, etc. Dehydration is by vac (and spray), normally at low temp, but oil can be heated to deal with high H_2O content. Test equipment in towing vehicle enables measurement of resistivity and elec strength (up to 80 kV, B.S. 148) to be carried out. V. B.

501. Tall oil fatty acids in floor wax. K. S. Kondrath, A. D. Nevers, and J. L. Eaton. *Soap, N.Y.*, Sept. 1957, **33** (9), 77.—The replacement of oleic acid in the emulsifier system floor polishes by tall oil fatty acid is described. Costs are reduced without significantly altering important characteristics of floor wax. G. A. C.

502. The reactions of hydrocarbon radicals on metal surfaces. G. C. Bond. *Paint Technol.*, 1957, **21** (239), 269.—A summarized version is given of the paper read to the Oil and Colour Chemists Assoc. Conference at Torquay, May 1957. The paper reviews the present knowledge of cat hydrogenation and related reactions on metal surfaces. Recent work has covered the relationships between the physiochemical properties of metals and their cat activity. Abridged discussion also included. D. K.

503. Place for emulsions as fire-resistant power transmission fluids. G. T. Coker, Jr., and C. E. Francis. *Lubric. Engng*, 1956, **12** (5), 323–6.—Extended application of hydraulically-powered industrial equipment has resulted in accentuated demands for fire-resistant hydraulic fluids. Details are presented of the development, characteristics, and performance of a water-in-oil emulsion type fluid with data on lab and field tests. J. G. H.

DERIVED CHEMICAL PRODUCTS

504. The synthetic detergent industry. Anon. *Inst. Petrol. Rev.*, 1957, **11** (131), 312.—A brief description is given of the Shell Chemical Co's detergent plant at Shell Haven. The plant has a capacity of 30,000 tons p.a. of high quality detergent alkylate. G. A. C.

505. The manufacture of paint and lacquer solvents from petroleum. F. E. Hixon. *Paint Technol.*, 1957, **21** (240), 306.—A summary of a paper read to the Oil and Colour Chemists Assoc. Conference at Torquay, May 1957. Solvents particularly considered are acetone, diacetone alcohol, *iso*-phorone, mesityl oxide, MIBK, and the aromatics. The OXO process is briefly described. A shortened version of the discussion is included. D. K.

506. Alcohol-ethylene oxide and related non-ionic surfactants. R. D. Fine. *Soap, N.Y.*, Sept. 1957, **33** (9), 50.—This class of non-ionic surfactants, used as alkali stable detergents, wetting agents, emulsifier, and drying assistants, is produced by reacting alcohols with ethylene oxide to form ether. G. A. C.

507. Non-ionic surfactants. R. D. Fine. *Soap, N.Y.*, Sept. 1957, **33** (9), 50.—The reaction products of ethylene oxide and alcohols as surfactants are discussed. These ethers from lipophilic alcohols are valuable as alkali stable detergents, wetting agents, dyeing assistants, and emulsifiers. Ether esters formed by reacting hydrophilic polyhydric alcohols with ethylene oxide and fatty acids are used as emulsifiers, lubricants, and softeners for textiles. D. K.

508. Ethylene oxide by the direct oxidation process. Pt 2. P. W. Sherwood. *Oil Gas J.*, 7.10.57, **55** (40), 150.—Pt 2 of

this work deals with 12 variables and their effects, and includes cat preparation, use of inhibitors, effects of temp, contact time, pressure, and impurities, ratios of reactants and recycle, inerts in feed gas, after-processing of reactor gas, and fluidized *v.* fixed-bed operation. G. A. C.

COAL, SHALE, AND PEAT

509. The Gas Council Report. Anon. *Petrol. Times*, 25.10.57, **61** (1571), 957.—The use of hydrocarbons in the manufacture of town gas is dealt with in the Gas Council's 8th annual report (H.M.S.O. 8*s.* net). Gasification of oil, gas from the refineries, search for natural gas, LPG, and imported methane are among subjects reviewed. G. A. C.

MISCELLANEOUS PRODUCTS

510. Oronite high temperature hydraulic fluids 8200 and 8515. N. W. Furby, R. L. Peeler, and R. I. Stirton. *Trans. Amer. Soc. Mech. Engrs*, 1957, **79** (5), 1029–38.—An account of the development of hydraulic fluids is given, and their important characteristics discussed. Emphasis is placed on the development of 2 new fluids, Oronite 8200 and 8515. Their properties are described and compared with those of other synthetic fluids. 2 pp. discussion and 7 refs. C. B.

CORROSION

511. What to do about hydrogen blistering. B. W. Neumaier and C. M. Schillmoller. *Petrol. Refin.*, 1957, **36** (9), 319–26.—Extensive damage to refinery equipment has been observed in the form of blistering and fissuring, particularly in the gas compression and fractionating units associated with cat cracking. This article describes the phenomenon of hydrogen penetration of steel and discusses several methods used by Richfield Oil Co to overcome this difficulty. The 2 major protective steps were early removal of H_2S and extensive water washing for removal of cyanides and aliphatic acids from the gas stream. In case of the inadequacy of these 2 steps a system of hydrogen probes was employed to detect hydrogen penetration at an early stage. Provision for injection of polysulphide and an organic corrosion inhibitor into various streams was also provided as a standby. Data are presented which show the total corrosive constituents in the process and also the percentage removal of these constituents by both water wash and diethanolamine treatment. J. R. T.

512. Corrosion prevention in gas condensate and sweet oil wells. M. Bock. *Petrol. Engr*, 1957, **29** (1), B111–22.—Causes and determination of corrosion in well equipment are described. Corrosion can be prevented by chemical inhibitors, protective coatings, effective equipment selection, proper operation techniques, and the use of corrosion-resistant alloys. Practical details of preventive techniques are discussed. E. A. G. H.

ENGINES AND AUTOMOTIVE EQUIPMENT

513. Design of pistons and piston rings. G. H. Clark. *Sci. Lubric.*, 1957, **9** (9), 18–25.—Importance of sound piston and piston ring design in the effective operation of marine engines is emphasized, and the connexion between sound piston design and efficient cooling discussed. Practical points in piston ring design are indicated, and ring flutter and bedding-in are considered in some detail. The functions and design of scraper rings and of piston rod glands are described and illustrated. J. G. H.

514. A combustion system for spark-fired gas engines using diesel compression ratios. L. D. Thompson, R. H. Beadle, and F. A. Blake. *Trans. Amer. Soc. Mech. Engrs*, 1957, **79** (4), 815–21.—The system, called jet ignition, consists of a spark-fired aux combustion chamber fed with gas under constant pressure connected through an orifice to the main combustion chamber. The main gas charge, throttle controlled by the engine governor, is ignited by the jet of flame from the aux chamber. The system enables the high thermal efficiencies of high C.R. gas engines to be obtained, while elimmating the necessity for pilot injection of liq fuel. The background to the development of the system is described and possible applications discussed. 2 pp. discussion. C. B.

515. Wax-controlled thermostatic valve for engine-cooling systems. Anon. *Mot. Ship*, Oct. 1957, **38** (449), 295.—The Waxtrol valve is claimed to be suitable for large marine diesels. The operating element is a container filled with a special wax and sealed with a flexible diaphragm and plug. The wax composition is such that a change in state occurs at the operating temp, causing a rapid increase in vol and power output. The valve unit, consisting of a piston assembly connected to a cylindrical slide valve, is actuated by the wax expansion. A diagram is included. D. K.

516. Prolonging cylinder liner life. Anon. *Mot. Ship*, Oct. 1957, **38** (449), 300.—The Vanderlay process consists of building up the bores of over-worn cyl liners by means of electrolytic iron plating and then superimposing a chrome layer. The system has been adopted in the U.S.A. and is now being applied in Holland. D. K.

517. Problems of fuel injection for gasoline engines. F. C. Mock. *Petrol. Engr*, 1957, **29** (2), C34–8.—Fuel injection is not in use because of its high cost. However, the advantages of injection, such as more power, a stable idle, and elimination of toxic exhaust gases may bring it into future use. E. A. G. H.

518. Vapour-phase cooling. Pt 4. G. Sanders. *Petrol. Engr*, 1957, **29** (1), D46–51.—Vapour-phase cooling occurs by partial evaporation of the water in an engine jacket. The coolant is at constant temp, so that temp differences and the attendant defects are reduced. A water pump is not needed, as flow proceeds by thermal circulation. The increased rate of heat transfer across the cyl walls results in smaller coolers. Low pressure steam generated can be used for heating, process work, or for driving engine aux. E. A. G. H.

SAFETY PRECAUTIONS

519. Prevention of cutting oil dermatoses. D. J. Birmingham. *Lubric. Engng*, 1957, **13** (3), 129–30.—Techniques for the prevention of industrial dermatitis call for full co-operation between medical and safety personnel. Essential features of education, medical supervision, personal hygiene, and the use of protective clothing are discussed in some detail. J. G. H.

520. Prevention of industrial dermatitis. M. L. Beardslee. *Lubric. Engng*, 1957, **13** (5), 275–7.—The necessity for personal cleanliness and for good preventive maintenance practices in metal-working plants is emphasized, and specific examples of the latter are indicated. J. G. H.

521. Scope of the problems of occupational dermatoses due to cutting oils. D. J. Birmingham. *Lubric. Engng*, 1957, **13** (1), 19–20.—In the last 10 years for which statistics are available the incidence of occupational dermatitis due to petroleum products has remained around 90% of total occupational dermatitis (U.S. statistics). Indirect and pre-disposing factors briefly discussed comprise race, type of skin, age, allergy, and lack of cleanliness. J. G. H.

522. Skin diseases caused by cutting oils. L. F. Weber. *Lubric. Engng*, 1957, **13** (2), 89–90.—Oil blackheads, dermatitis, defatting of the skin, granulomas, melanoderma, chloracne, and cancer are briefly discussed, with reference to exposure to action of oils as causes. J. G. H.

523. Safer loading-rack operations at pipeline terminals. C. H. Scruggs and D. L. Hope. *Oil Gas J.*, 28.10.57, **55** (43), 109.—Removal of hazard of static electricity from rail and road cars at product pipeline terminals is described. All structures and fixed equipments are grounded, but charge-bearing vessels moved into the area must also be dealt with. A magnetic amplifier is used for evaluating circuit resistance of grounding connexions. Tables give results of tests to determine charges, and of measured charging voltages. Diagrams give equipment circuits. G. A. C.

MISCELLANEOUS

524. Pollution abatement in the petroleum refining industry. A. W. W. Kirby. *Inst. Petrol. Rev.*, 1957, **11** (131), 289.—The history of atmospheric pollution, the Clean Air Act of 1956, emission of grit, dirt, and smoke, flaring of surplus gas, dispersion of flue gases, malodour problems, masking cpds, Los Angeles smog, water pollution, elimination of oil from effluent, and common law liability are dealt with in this paper. G. A. C.

525. The Cadman Memorial Lecture. Oil and education. Anon. *Petrol. Times*, 8.11.57, **61** (1572), 995.—The lecture delivered by Lord Godber, Chairman of the "Shell" Transport & Trading Co Ltd, in London, Oct. 1957, dealt with the broad principles of education, and the oil industry's responsibilities within the general framework, a review of the industry's activities in different countries, and general trends were deduced from a chronological account. G. A. C.

526. Fuel research in 1956. Anon. *Petrol. Times*, 8.11.57, **61** (1572), 996.—A recent report by the Fuel Research Board of the DSIR is reviewed. Subjects include production of oil synthetically from coal based on Fischer–Tropsch process, thickening of oil on storage, exhaust gases from motor vehicles, and effect of γ radiation on cat. G. A. C.

527. Nuclear reactors seen as process tool. M. R. Dusbabek. *Petrol. Refin.*, 1957, **36** (9), 243–8.—Application of nuclear reactors to the petroleum and petroleum chemical industries is considered. The case of employing radiation in a cracking process is postulated, and a schematic diagram of such a process is shown. The control characteristics of nuclear reactors are discussed and several other attributes outlined. J. R. T.

528. The consumption of material by the chemical industry. (In German.) H. Wittmeyer and F. Hanck. *Chem. Ind.*, 1957, **9** (7), 301–4.—The consumption of material by the German chemical industry is compared for the years 1936, 1953, 1954, and 1955. Data given include figures for the oil industry. P. J. K.

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OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

529. Component dip nomogram. J. Bemrose. *World Oil*, 1957, **145** (5), 140.—A circular nomogram is presented from which it is possible to determine the magnitude and direction of component dip from the magnitude and direction of true dip. The nomogram is based on the following relationship: if α is the true dip and α' is the component of the true dip in a direction which makes an angle ϕ with the direction of true dip, $\tan \alpha' = \tan \alpha \cos \phi$.

An example of the use of the nomogram is given.

C. A. F.

F

530. Activity is picking up in Eastern Kansas. F. W. Morgan and M. E. Torline. *World Oil*, 1957, **145** (5), 130.—New fields are being sought in E. Kansas on the W. flank of the Chatauqua Arch, where Mississippian and older accumulations occur beneath the Pennsylvanian which carries sand fields.

The geology of the area is described with particular reference to the pre-Pennsylvanian, which consists of the Mississippian, in which massive limestones and dolomites are conspicuous, and the Ordovician. On the Chatauqua Arch and on its W. flank all the Siluro-Devonian and Upper Ordovician have been removed and the Mississippian rests on Lower Ordovician Arbuckle dolomites. In the Mississippian porosity seems to be related to structural position, but the Arbuckle usually has well developed porosity and an effective water drive.

Recent exploration has been essentiallyby wildcatting aided by subsurface geology, and this type of drilling is favoured by shallow pays, the Arbuckle being only *ca* 2600–2700 ft at its max depth in SW. Chatauqua County. A fairly high proportion of these wells have been successful. 4 refs.

C. A. F.

531. Oil and gas exploration in Ontario. F. L. Fournier. *Canad. Min. metall. Bull.*, 1957, **50** (545), 565–8.—Oil and/or gas is found in 5 geological horizons. In the Dundee formation (Devonian) it occurs at depths of <500 ft. There are 2 pay zones in the Salina formation, of Silurian age, at depths down to 2000 ft, below this—also of Silurian age—is the Guelph, the most prolific zone. The deepest horizon, the Trenton, may require wells down to 2000 ft. All producing zones are in dolomite or limestone, excepting a Silurian sandstone production at the E. end of lake Erie. The geology of the >2000 sq. miles of SW. Ontario is described with a supporting map. Gravity surveys have proved successful in revealing anomalies which may prove to be pinnacle reefs. Coral reef growth is discussed in relation to oil and gas retention. S. of the Cincinnati Arch fields have been discovered with the gravity meter since 1950, which are not on pinnacle reefs. Tilbury field discovered in 1906, the largest gas field ever discovered in the province—with total ultimate reserves 300 billion ft^3—extends $\lessapprox 5$ miles into Lake Erie, where *ca* 35 gas wells have been drilled on the lake. The Ontario Government has set new, very fair regulations to encourage exploration. Prospecting is particularly attractive to the small operator because 4 of the 5 producing zones are at depths <2000 ft. Well-head prices are the highest in Canada.

R. T.

532. Geodetic survey to spur Latin American oil growth. Anon. *World Oil*, 1957, **145** (5), 127.—The organization of the Inter-American Geodetic Survey (IAGS) is described. It was set up in 1946 in order to carry out a comprehensive cartographic mapping programme in Central and S. America. The U.S.A. and 17 other nations are contributing to the project, which involves expenditure of $12–14 million each year and employs some 5000 people. The organization covers over 12 million sq. miles, and the minimum aim is the establishment of 90,000 miles of primary triangulation arcs, 195,000 miles of primary level lines, and 250 base lines. Astronomical, tidal, and geophysical data are also being collected.

The project is of fundamental importance for the economic development of many areas, and oil companies are already making use of ground data from IAGS for control in aerial surveys.

C. A. F.

533. The outlook offshore. I. H. Cram. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 48–53.—This economic evaluation of offshore exploration and production in the Louisiana–Texas coastal area includes statistical data and some comparisons with the onshore investments and discovery results. It takes into consideration the political background from the time of the first lease sale in Louisiana to the Supreme Court injunction in 1956. Every production man knows he has the same job offshore that he has onshore; namely, progressively and relentlessly to reduce costs—costs of drilling, lifting, workovers, transportation, *ad infinitum*. If either industry or government, or both, needs ammunition to convince themselves that statesmanship of the highest order is now a must, they need only to reflect on the importance of the offshore deposits to the nation. (Author's abstract.)

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

534. Sub-sea seismic tool. Anon. *Petrol. Engr*, 1957, **29** (3), B134–40.—Successful explorations of the ocean floor and sediments beneath it are being made with a new echo sounder using high-powered low frequency sound waves. The rapid surveying rate of the instrument indicates many potential uses.

E. A. G. H.

535. Seismic "fan" method. A. Kislow. *Nafta* (*Krakow*), 1957, **13**, 128–30.—This method is some 10 years older than reflection method. The author reviews results obtained in France, Italy, and Holland. Considering that this method enables progress to be made in great strides over terrain which does not require very detailed investigation at first, it may be of great use in the preliminary search in the Polish lowlands.

M. S.

536. Geochemical methods of oil and gas exploration. B. P. Yasyenyev. *Nafta* (*Krakow*), 1957, **13**, 107–9.—During the preceding years the field work on geochemical prospecting methods and research into its problems have been largely neglected. This attitude has been severely criticized, since the method is known to be valuable. Author considers that initial disappointment was due not to the method being at fault but that the quantity of hydrocarbons detected was a pointer to a source other than an oilfield. The method is of greatest help once a syncline has been located.

M. S.

DRILLING

537. New drilling developments. W. B. Brooks, L. W. Randerson, and F. W. Schall. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 91–105.—Since the first oil well was drilled, hundreds of drilling devices and techniques have been either field-tested or at least suggested as being worthy of consideration and experimentation. This paper is a review of several of the new drilling techniques and improvements in conventional methods. An indication of the potential applicability and the limitations of each method is included in the discussion. Some of the methods discussed are impractical for ordinary oil-well drilling, but might find application with improved technology and metallurgy. Some of the methods discussed have already proved their economic worth.

(Authors' abstract.)

538. Will the supply of casing and tubing be adequate for to-morrow's drilling? H. W. Ladd. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 33–7.—Recent supply and demand forecasts for the next decade are in excess of earlier forecasts. An ever-increasing number of wells will be necessary. The tubular goods mills collectively have not always received the steel needed to maintain the max production required to meet petroleum industry needs. It is reported that the oil and gas industry receives directly from steel mills only *ca* 7% of the total steel produced in the U.S.A., 3% of which is oil country tubular goods. For tubular goods to be delivered during any

given quarter, the mills open their order books for the placement of business during the first part of the preceding quarter. Tubular goods are then allocated on the basis of tonnage and of items which can be ordered to make up that tonnage. The steel companies are committed to a schedule of 15 million tons of new capacity during the next 3 years. If all the new mills are built and present oil country goods capacities are expanded according to plan, and if the steel is available as expected, it should be possible to secure, to 1960 at least, most of the material required to continue drilling at the past established rate of increase. (Author's abstract.)

539. The challenge of drilling costs. A. W. Thompson. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 63–6.—The contract drilling industry is made up of over 1000 firms owning 4000 rigs representing an investment of over $500 million. Annual gross income exceeds $1 billion, and the percentage of total drilling performed by contractors increased from 81 in 1946 to 92 in 1955. Despite its size, the contract drilling industry is an essentially unstable one, passing repeatedly through cycles of over-expansion and liquidation. The contractors' record of accomplishment over the past 10 years is impressive. Despite an approx doubling of labour, equipment, and miscellaneous costs, footage rates dropped 4% over the period, with this achievement being due to a 188% increase in average rate of penetration. However, the industry is believed to have exploited nearly to the full the means by which this increase was achieved, so that it is not to be expected that the increase can be prolonged throughout the next 10 years unless the industry explores new methods of cost reduction. Attention is directed to the industry's low expenditure on research and to the need for equipment of lesser weight. Suppliers are asked to eliminate unnecessary rig calls by their salesmen. Specific operator practices, which are considered to raise costs unnecessarily are pointed out.
(Author's abstract.)

540. Design of combined casing columns. J. Hefferan and F. Inguanzo. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 527–47.—Based on the co-axial stress relationship, a method is derived which permits design of combined casing columns through the collapse interval without resorting to the usual cut-and-try method. A set of illustrative nomograms is presented to solve the case for 6⅝-inch casing. Additional tables are included for a quicker analytical solution for other dia. Any values for safety factors and weights, as well as buoyancy, may be considered. (Authors' abstract.)

541. Investigations on and suggestions for the employment of lightweight steel construction for oil drilling and production equipment. G. Bierett and E. Bahke. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 501–25.—For the introduction of mobile implements, particularly in drilling equipment, new styles of design had to be searched for. The mentioned points of view, constructive performance after streamline features, dissolution of compact sections in straddled folded sections, deformation and oscillatory qualities as well as damping elements, constitute the basis of developments of a light steel construction. These tasks are in close connexion with quick and easy transporting and assembling, and multiple employing of elements necessary in respect to the design. The tube, or shell-type construction, will become the ever-more-prevailing construction element in future. In this respect, the problem of stability plays the decisive role. The cell is characterized by the ratio of dia and thickness of wall D/s, which indicates the shock-resistance of the material used. To-day's drilling machinery is a great improvement over that of a decade ago; there will be additional improvements in the future. Manufacturers are finding ways to reduce the size and weight of components. In future exploration of impassable terrains, such as jungle or mountains, where the whole drilling equipment may have to be flown in, possibly by helicopters, the least saving of weight or vol may mean economic profit. The modern thinking man will have to get acquainted with lightweight construction ideas to cut down dead weight in machines and equipment. (Authors' abstract.)

542. The influence of the masses and moments of inertia of the moving parts of a drilling installation on its hoisting performance. H. M. Hohmann and B. E. Busking. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 441–55.—In order to study the hoisting performance of an engine-driven drilling installation, the masses and moments of inertia of the rotating and moving parts of the installation were first evaluated by application of a practical method which is fully described. With these data available, calculations were made of acceleration and hoisting times for different loads and the various drive speeds of the hoist for 2 methods of operation; one in which engagement of the main friction clutch takes place at max engine speed and torque, and one in which engagement is effected at the idling speed of the prime movers. The computed results were then checked against the operating results of a similar installation, using a recorder designed especially for this purpose. Measured values correlated satisfactorily with calculated values and provided evidence of deviations from best attainable results, attributable to the technique of the driller in operating the drawworks. In general, the field observations demonstrated what was already apparent from the calculations, that hoisting and acceleration times are greatly dependent upon the degree of skill applied by the driller. From the study an insight was obtained regarding the optimum distribution of moments of inertia of the different moving parts of the installation. The main friction clutch should be located as close to the load as possible and this clutch should be engaged at the highest permissible speed to minimize acceleration times and total hoisting times. With a normal mechanical transmission speed, changes during hoisting are not practicable and the max speed of the load is governed by the max speed of the engine and the transmission ratio engaged. Once this max speed has been attained, there is no further acceleration possible and the power that was used for acceleration becomes free but cannot be utilized during the remainder of the lifting period. For this reason, manufacturers' data concerning max hoisting capacity in relation to h.p. and speed are not properly descriptive of the possibilities of particular installations unless a figure is given for the distance of travel of the hook within which listed speeds are attainable. Torque converters can compensate to a large extent for any lack of applied skill on the part of the driller in operating a hoist to best advantage.
(Authors' abstract.)

543. Techniques of drilling and producing high drift angle directional wells. D. S. Johnston and J. T. Carriel. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 107–29.—During the past 4 years the authors' companies have been developing leases between one and 2 miles offshore at Huntington Beach, California, by directional drilling from onshore sites. 87 wells with drift angles over 60° have been drilled and completed. In order to conduct this operation on a routine basis it has been necessary to design new tools and adopt methods not previously considered in the art. In addition to directional control and well surveying techniques, problems in hole conditioning, drill pipe protection, electrical logging, running casing, cementing, well completion, and production have had to be resolved. (Authors' abstract.)

544. Modern lightweight drilling strings gaining in popularity. W. L. Baker. *World Oil*, 1957, **145** (5), 195.—Lightweight drill pipe is being increasingly used, particularly in Venezuela, where it has given very satisfactory results. The pipe is in various grades weighing under 14 lb/ft, and special tool joints

have recently been developed which give improved performance. Details of the use of the pipe in Venezuela are given, a total of 10 lightweight strings now being used in the country. Most of these are 4½-inch pipe, and they are in use by several companies.

The chief advantage of the pipe is weight reduction, so that smaller capacity rigs can be used to reach a given depth. A 4½-inch lightweight string of 10,000 ft weighs approx 21% less than a standard-weight string of the same length and dia.
C. A. F.

545. A case for small hole completions. G. E. Cannon and R. A. Watson. *Petrol. Engr*, 1957, **29** (5), B82–8.—Use of reduced dia casing and smaller equipment has decreased well costs by 14% in 304 Texas wells. Improved mud pumps capable of operating at the pressures required by high pressure losses in slim holes, improvements in the control of mud properties, and development of well completion techniques for slim holes have contributed to the success of the drilling programme. E. A. G. H.

546. Air and gas drilling cuts costs 22 per cent. J. H. Adams. *Petrol. Engr*, 1957, **29** (5), B30–4.—Rotary drilling with air or gas as a circulating medium was successful in drilling 4 wells in the hard rock area of E. Oklahoma and NW. Arkansas. The penetration rate was faster and the number of bits used was much less than for mud-drilled wells in the area. Formation water caused difficulties. E. A. G. H.

547. Development trends in construction of drilling equipment. J. Ostaszewski. *Nafta (Krakow)*, 1947, **13**, 94–8.—Polish production of drilling equipment is hampered by poor quality of steels available. Strength can be achieved only by thickness of metal, and this makes transport difficult, but for the future the author points to other peoples achievement and the quality of Polish and Rumanian research equipment. All this is reviewed from the standpoint of greatest usefulness to the Polish petroleum industry. A list of suitable American and German drilling rigs is given. M. S.

548. Interpretations of the induction-electrical log in fresh mud. J. L. Dumanoir, M. P. Tixier, and M. Martin. *J. Petrol. Tech.*, July 1957, **9** (7), AIMME Tech. Paper No. 4610, 202–17.—In a single run the induction-electrical log records S.P., a 16-inch short normal curve, and a 40-inch induction log with a focusing system. This system makes qualitative and often quantitative determinations possible for the fluid content, particularly in thin beds.

After reviewing fluid distribution in the invaded zone, some characteristics of the induction log are discussed—its response in shales, the effect of the mud column, of invasion, of adjacent formations, and of the presence of oil or water in the formations.

Theoretical departure curves have been obtained on the basis of certain assumptions, and a practical interpretation chart is given for thick beds of low or moderate resistivity, note being taken of the bank of formation water. Field examples are discussed. Despite the approx nature of the chart, it seems that under usual conditions it gives reliable help in determining saturations. G. D. H.

549. Bottom-hole pressure reduction due to gas-cut mud. R. J. White. *J. Petrol. Tech.*, July 1957, **9** (7), 49–50.—Strong gave the relationship between pressure and depth for a gas-cut mud as

$$h = \frac{1}{D}\left[P + \frac{pn}{100}\, ln \frac{P + p\left(1 - \frac{n}{100}\right)}{p\left(1 - \frac{n}{100}\right)}\right]$$

where h is depth in ft, P the pressure in atm at depth h due to mud column only, D is pressure in atm of 1 ft of un-cut mud, p is back-pressure at well-head in atm, and $\frac{n}{100}$ is the fraction vol of gas in the mud at p. This expression includes an error which makes the computed values less accurate the higher the gas content. Correction of the error gives the relationship

$$h = \frac{1}{D}\left[P + \frac{np}{100 - n}\ \ln\left(\frac{P + p}{p}\right)\right]$$

If the well-head is open the loss in head is $hD - P = \frac{n}{100\text{-}n}$ ln $(P + 1)$, which can be solved by successive approximation.

A 10-lb/gal mud cut by 50% at the surface reduces the head at the bottom of a 5000-ft well by only 3%. G. D. H.

550. How low solids muds can cut drilling costs. H. E. Mallory. *Petrol. Engr*, 1957, **29** (4), B21–4.—The solids content of drilling muds may be controlled by the use of air, centrifuges, or flocculents. Water and oil emulsions, or even water alone, may increase penetration rates, and reduce the numbers of bits required and drilling time, resulting in lower drilling costs. E. A. G. H.

551. Everybody loves the centrifuge! R. W. Williams and J. Mesaros. *Petrol. Engr*, 1957, **29** (4), B44–9.—Centrifuges are being used to extract solids from drilling muds so that costly watering procedures to reduce the solids content of muds are needed less often. Proper operation techniques recover most of the barites used in making muds, thus reducing operating costs. E. A. G. H.

552. How mud properties affect drilling rate. R. A. Cunningham and W. C. Gains, Jr. *Petrol. Engr*, 1957, **29** (5), B119–31.—Oil added to a lime base mud increased drilling rates in Gulf Coast shales and reduced bit balling during lab tests simulating actual conditions. The oil eliminates friction losses between the drill stem and the wall of the hole, thus improving the weight on the bit. Soft shales are kneaded by the bit into a material which when mixed with water or mud forms a thick paste that may extrude up around the bit to cause severe balling. Decreasing fluid loss properties by adding starch reduced drilling rates. Water with an added rust inhibitor appreciably increased drilling rates, forming an enlarged hole of irregular shape. E. A. G. H.

553. The unstable behaviour of shale formations in boreholes and its control by properly adjusted mud-flush quality. J. H. M. A. Thomeer. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 1–10.—Shaly formations are often a source of trouble in oil well drilling as a result of their leaning to deformation and caving. Whilst this unstable behaviour of shales appears to be a rather complex phenomenon, its main cause should probably be sought in the disturbance of pressure equilibrium which is created by the drilling of a hole through them. To a greater extent than other rocks, shaly formations are likely to yield to pressure differentials, as a result of their inherent plasticity or elasticity. Whilst a certain degree of unstability thus appears to be a natural quality of all clays and shales, certain shale rocks of greater depth may prove to be particularly troublesome as a result of excessive fluid pressures prevailing in their pores or cracks. Serious complications which may arise from this shale instability can best be avoided by the application of the proper drilling technique coupled to the use of a mud-flush having special and rigidly balanced properties. The exact requirements in regard to some of these latter are better known as yet from field experiences than from theory. Further research on this subject might well lead to still better muds and safer deep drilling.
(Author's abstract.)

554. Flow characteristics of oil base drilling fluid. H. D. N. Fitzpatrick. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 11–24.—The relationship between pressure drop and rate of flow for oil base drilling fluid flowing through 3-inch pipeline and 4½-inch drillpipe has been studied experimentally. The visc of the same fluids was also studied and a new viscometer designed that is suitable for use in the field. It was found that the fluids behave like Bingham bodies in streamline flow and follow the Fanning equation in turbulent flow. The rigidity (or plastic visc) exhibited in streamline flow was higher than the effective visc in turbulent flow (the turbulent visc): the rigidity measured by a viscometer on a freshly drawn sample is effectively the turbulent visc. Circulating pressures in a drilling well system have been calculated and agree reasonably well with the observed values; similar calculations may be used to find the size of drill pipe which gives the lowest pressure drop in a given hole.

(Author's abstract.)

555. Symposium on drilling mud presented by the "Mud" Commission. C. Ricard. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 25–42.—(1) *Institut Français du Pétrole.* (*a*) An inquiry is made into the behaviour of drilling muds at a high temp and under high pressure (250° C, 1000 kg/cm²), by means of a specially designed apparatus by which the various characteristics of the muds may be measured both after heating and at the actual temp of heating, under both static and dynamic conditions. A brief note is given of the results that have already been obtained experimentally. (*b*) A new method is proposed for the quantitative evaluation of the colloidal products used in the technique of drilling muds. This consists in attributing to these products technico-economical indices—a method which allows their rational classification, by taking into account their properties and prices. (*c*) A description is given of 2 apparatuses by which the rheological characteristics of drilling muds may be continuously measured; one of these, with cylindrical pipes, is fitted for field uses; the other, with coaxial cyl, is better suited for the lab. In any case, the method of immediate, continuous, and automatic measurement is important, no matter what type of viscosimeter is used, provided that the flow curve, under laminar conditions, is a straight (or a nearly straight) line.

(2) *Société Nationale des Pétroles d'Aquitaine.* The discovery at Lacq of a deep-seated deposit of abnormal pressure and containing "sour gas" has raised several problems (filling problems in zones of leakage; problems of drilling with a total loss of circulation). A report is given on drilling work which has been carried out.

(3) *Régie Autonome des Pétroles.* For technical and economic motives, researches have been carried out on the conditions in which various substances should be used in drilling muds (especially as regards feculas and fucus). Humic acids are here brought into general use.

(Author's abstract.)

556. Some aspects of high weight muds used in drilling abnormally high pressure formations. P. W. Cooke. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 43–58.—Frequently potential reservoirs are encountered possessing pressures approaching the overburden pressure which require very heavy mud weights for safety of control when drilling through such formations. The control and preparation of high density muds present special problems, since the high solids content of the mud is a constant source of visc trouble and the circulation of such muds necessitates high pumping pressures for optimum flow rates. A major problem in the penetration of abnormally high pressured zones is the effect of the increasing hydrostatic mud pressure differential on the formation as drilling proceeds, culminating frequently in lost circulation. This paper discusses in some detail the 2 principal mud types for penetrating high pressure zones, with particular reference to their physical composition. Reference is made to a particular well drilled in which a heavy mud was employed for over 8000 ft. The problems of lost circulation and the hydraulics of circulating very heavy muds are analysed. Some observations on the effect of mud weight on penetration rate are also included. (Author's abstract.)

557. A general theory of Eltranslog. A. Belluigi. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 275–84.—The activation of electromagnetic transients in an indefinite conductive medium (such as the ground) has been the object of many theoretical and experimental researches in recent years. Owing to the different purposes of these researches (generally of electrotechnical character), most of the theories stated so far show only partial aspects of the electromagnetic geotrans. For this reason the author proceeded to new theoretical developments more strictly adherent to the problems of prospection with geoelmatrans methods. Starting from the bipolar electromagnetic energization of the ground (step-function currents) a series of theoretical determinations have been derived in conditions favourable to the Eltranslog purposes. From the theory dealt with in this paper (a conclusion of a series of studies carried out by the author and others on this subject) new important properties of geoeltrans may be deduced and, consequently, measurements of geoelmatrans quantities acquire more and more advantageous characteristics, with a net superiority over the electromagnetic quantities of regimen (as already mentioned by the author). (Author's abstract.)

558. A new method of taking fluid samples in formations. J. Delacour. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 285–97.—The purpose of this report is to illustrate a new method of taking fluid samples from formations traversed by drilling. The equipment consists of a series of suction core barrels operated by means of a lateral core of the conventional type. Each core barrel adheres to the boring wall at the level of the formation studied. The fluid from the interstices is then sucked inside the core barrel chamber, where it remains until recovered above ground. Numerous practical experiments made with suction core barrels have shown that gas and oil samples can be taken in the immediate vicinity of the boring walls. (Author's abstract.)

559. Symposium on well bore surveys. J. E. Walstrom. *Proc. Fourth World Petrol Congr.*, 1955, **2**, 155–273.—When a hole has been drilled, or at intervals during the drilling, it is a general practice to run an electrical survey or a radioactivity survey to secure a complete record of the formations penetrated. Such recordings are of immediate value for the geological correlation of the strata, and also for the detection and evaluation of possibly productive horizons. In the present state of the electric logging technique, several different kinds of resistivity curves or logs can be recorded in boreholes in addition to the potential, or "S.P." curve. The various types of resistivity logs correspond to the use of different resistivity measuring devices, and are accordingly designated as conventional logs, Laterolog, Guard Electrode Log, Induction Log, Microlog, Micro-Laterolog, and Contact Log. Radioactivity logging includes the γ and neutron logs, which, respectively, record the natural radioactivity of the formations and the effects due to bombardment of the formations by neutrons. Furthermore, the information obtained from electrical or radioactivity logs may be supplemented by sidewall cores of the formations taken from the walls of the hole, or by other types of investigations which can be performed in drill holes, such as caliper surveys, directional surveys, dipmeter surveys, temp surveys, and several others. Many of these logging and evaluation methods, including logs and surveys

made in producing wells, are separately described in the articles comprising this symposium on well bore surveys.
(Author's abstract.)

560. Bit hydraulics for hard-rock drilling. R. J. Bromell. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 104–12.—The objectives set forth for this API Southwestern District Study Committee on Jet-bit Drilling have been partially fulfilled. These objectives as originally set forth were: (1) develop recommendations for the proper application of hydraulic h.p. in drilling operations; (2) determine the upper and lower limits of hydraulic h.p. applied to jet-bit drilling. It has been established that jet bits are of doubtful advantage at drilling rates of less than 14 ft/hr. The effectiveness of jet bits within certain limited ranges has been established, but there is a need for more work in the higher h.p. ranges at faster drilling rates. (Author's abstract.)

561. Certain principles of dynamics of rock bit action. R. Piatkiewicz. *Nafta (Krakow)*, 1957, **13**, 109–10.—Due to the elasticity of the rock, the action of the bit tooth is in fact a series of steps. R. M. Engeles considers this to depend on speed and applied pressure. 2 formulae are suggested.
M. S.

562. Wireline retractable rock bits. J. M. Camp, J. E. Ortloff, and R. H. Blood. *World Oil*, 1957, **145** (5), 190.—Tests have been carried out on wells in the Mid-Continent area of the U.S.A. to determine the economics of drilling with casing and retractable rock bits. The results indicate that there should be substantial savings in drilling costs using these methods, the predicted savings (up to 25%) being based on reductions in time, equipment, investment, and labour due to the elimination of the need for round trips to change bits.

Tests have been made with 3-cone and 4-cone bits which have been run in on wireline and turned with the casing. The bits are collapsed to pass through the casing bore and then expanded to the cutting dia. Details of the tests are given with tables. C. A. F.

563. Polish turbo-drills type "Turbokret I" and "Turbokret II". S. Karlic. *Nafta (Krakow)*, 1957, **13**, 134–8.—Although the prototype of a turbo-drill was constructed in 1923 and the idea of power drive from the bottom of the well (rather than from the surface) is older still, technical difficulties at the time made it necessary to shelve that idea till 1935, and after the war the project was successfully completed. For 4 years work has been going on at the Polish IP and at the equipment works to make a turbo-drill of Polish design and 2 prototypes are being tested one 308 mm, the other 216 mm dia. The article discusses theoretical principles of construction, and diagrams of the prototype are included.
M. S.

564. Quick rigging up and tearing down of rotary drilling rigs. M. Massarenti. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 567–72.—The author describes a new, speedy, and safe way of rigging up the standard derricks by employing 4 gin poles fastened to derrick legs instead of the usual gin pole positioned in the centre. (Author's abstract.)

565. Offshore well workovers. J. E. Kastrop. *Petrol. Engr*, 1957, **29** (6), B27–32.—The high cost of drilling and maintaining offshore wells requires the application of more efficient techniques. It is calculated that the average offshore well will barely pay the workover costs. Methods for alleviating the causes of well workovers are presented. The applications of permanent completions, specially designed workover rigs, and wire line units should lower workover costs.
E. A. G. H.

566. California operators develop underwater drilling. J. A. LeVelle. *Petrol. Engr*, 1957, **29** (6), B37–44.—Open ocean, high tides, currents, and a steeply shelving ocean floor off California have made the development of new offshore drilling techniques necessary. Core drilling from anchored barges has been accomplished in water up to 250 ft deep, and most of the operations necessary for well completion have been carried out; however, problems of inspection, workovers, and provision of artificial lift remain. E. A. G. H.

567. "Mr Arthur"—new mobile submersible drilling giant. H. B. Elder, Jr. *Petrol. Engr*, 1957, **29** (6), B53–61.—A large drilling unit with an elevated deck which is self-stabilizing, submersible, and designed to drill to 20,000 ft in water depths up to 70 ft. Drilling equipment is entirely diesel-electric driven. E. A. G. H.

568. Completing a high-pressure offshore well. H. Simpson. *Petrol. Engr*, 1957, **29** (6), B62–8.–Difficulties of gas-cut mud, a failure in the lower section of casing, and a calculated bottom-hole pressure of 9650 p.s.i. were experienced in a 17,000-ft-deep offshore well. Completion was successful after using conditioned mud and a 5-inch liner to overcome leaks.
E. A. G. H.

569. Controlling wild wells. D. M. Taylor. *Petrol. Engr*, 1957, **29** (6), B74–82.—Blowouts at the surface on land or offshore may be controlled by a simple new method using a heavy caisson and a sealing device. E. A. G. H.

570. Jet rings to facilitate caisson penetration. J. W. Peret. *Petrol. Engr*, 1957, **29** (6), B132–46.—Large dia caisson columns are used in offshore drilling to support wellhead equipment. Wave forces set up a horizontal force, and the column must penetrate the ocean floor sufficiently to avoid yielding. Hydraulic equipment, capable of very high pressures, drives the caisson into the sea bed. The use of a jet ring on the lower end of the caisson assists in preventing a premature driving reaction and avoids failure due to excessive pressure. E. A. G. H.

571. Newest helicopter offshore navigation aid. Anon. *Petrol. Engr*, 1957, **29** (6), B158–60.—A new electronic navigator system enables a helicopter to transport men and materials to offshore oil locations in fog and at night over a 100-mile range. E. A. G. H.

572. Skid-mounted offshore workover rig. R. J. Silberman. *Petrol. Engr*, 1957, **29** (6), B172–82.—A new piece of offshore self-contained portable equipment has been designed to perform workovers to 15,000 ft and drilling to 6000 ft. It is claimed that the unit is more economical than the tender-platform unit if the job takes up to 7 days. E. A. G. H.

573. New Lake Maracaibo drilling tenders. W. E. Harrelson. *Petrol. Engr*, 1957, **29** (6), B183–5.—Drilling barges of the floating platform type, on which standard skid-mounted drilling equipment is operated, are used in Venezuela. Barge and equipment details are given. E. A. G. H.

574. Foundation problems for marine drilling platforms. A. Kranendonk. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 457–78.—When drilling oil wells in submerged areas one of the major difficulties encountered is that of the foundation for the drilling equipment. In the course of developing a suitable and economical type of foundation many problems arise, necessitating studies in various fields of science. The object of the paper is to discuss the problems involved and to describe types of foundations designed and executed in various parts of the world. (Author's abstract.)

PRODUCTION

575. Rheological measurements of non-Newtonian fluids. L. L. Melton and C. D. Saunders. *J. Petrol. Tech.*, July 1957, **9** (7), AIMME Tech. Paper No. 4609, 196–201.—A general method of analysis is presented for handling data on Newtonian and non-Newtonian fluids. This is also independent of the type of viscometer used, but cannot be applied to thixotropic or rheopectic fluids. Shear stress is plotted against rate of shear on log/log paper. For capillary viscometers the shear stress is $\frac{D\Delta P}{4L}$ and the rate of shear

$$3\left(\frac{8Q}{\pi L^3}\right) + \frac{D\Delta P}{4L}\left[\frac{d(8Q/\pi L^3)}{d(L\Delta P/4L)}\right];$$

for the concentric cyl apparatus the shear stress is $\frac{T}{2\pi h r_i^2}$ and the rate of shear $\frac{2\tau(d\omega/d\tau)}{1-(r_i/r_o)^{2n}}$. τ is the shear stress, r_i is the radius of the inner cyl, r_o the radius of the outer cylinder, T is the torque, ω the angular velocity, and $n = d \log \omega/d \log \tau$ at the value of τ in question.

The plots are linear, data for a motor oil, calcium carbonate slurry, and modified starch gel being used for purposes of illustration. The fundamental nature of the method is shown when the data are correlated by the conventional friction factor–Reynolds No. analysis for flow through cylindrical ducts. The former factor $f = \frac{D\Delta P}{4L}\left/\frac{\rho V^2}{2g_c}\right.$ and $N_{Re} = \frac{D^{n'}V^{2-n'}\rho}{\gamma}$; $\gamma = g_c K' 8^{n'-1}$, where K' is $(D\Delta P/4L)/(8V/D^{n'})$ at the value of $D\Delta P/4L$ in question, and n' is $d\,ln\,(D\Delta P/4L)/d\,ln\,(8\,V/D)$. G. D. H.

576. Potentiometric analyser prediction of pressure distribution in a gas-condensate reservoir. H. B. Bradley and L. D. Mullins. *J. Petrol. Tech.*, Sept. 1957, **9** (9), 59–60.—In the potentiometric model of the reservoir isopotential lines are drawn based on voltage differences between a reference point and points other than wells for a given injection/production rate schedule. Muskat has shown that the potential distribution in a gas-condensate reservoir corresponding to the voltage distribution in the model is a function $\Phi_g = \int_o^p \frac{\rho_g}{\mu_g}\,dp$. Plots of ρ_g/μ_g against p are constructed, and graphical integration is used to get plots of Φ_g against p. The reservoir potential Φ_g is linked with the model potential Φ by a scaling factor. Also a relationship is established between the volumetric weighted average datum pressure and the mean (volumetric weighted) potential in the model.

A knowledge of the pressure distribution for a specific injection/production programme is helpful in deciding whether conditions exist for retrograde condensation. The limitations of the technique include the impossibility of getting pressures in the immediate vicinity of a well, because of the relatively large size of the electrodes. G. D. H.

577. Mobility of connate water during a water flood. W. O. Brown. *J. Petrol. Tech.*, July 1957, **9** (7), AIMME Tech. Paper No. 4608, 190–5.—Experiments have been made using loose sand in long tubes to study the mobility of connate water during a water flood. The effects of rate, column length, and oil visc were examined. It was concluded that the connate water does the actual displacing by forming a continuous barrier between the oil phase and the injected water. Hence additives could not make contact with the oil to increase the efficiency of the initial oil displacement. The first water produced in flooding operations will have the composition of the connate water, because there is complete displacement, the mechanism being similar to single-phase miscible-fluid displacement.

The efficiency of connate water displacement was lower with a high visc oil than with one of low visc. G. D. H.

578. Calculation of the depletion history and future performance of a gas-cap-drive reservoir. J. E. Kirby, H. E. Stamm, and L. B. Schnitz. *J. Petrol. Tech.*, July 1957, **9** (7), AIMME Tech. Paper, 218–26.—Equations developed for combination-drive reservoirs have been successfully applied to match the past performance of a gas-cap drive reservoir, and to predict the future performance under primary depletion, pressure maintenance by gas injection, and pressure maintenance by water injection. Digital computing equipment was used, but the procedures are also suitable for desk calculators.

In the computations note was taken of well capacities and allowances, as well as of penalties for high gas/oil ratio production, and ultimate depletion of the gas reserve was considered. The Frio reservoir considered was estimated to give 28% of its original oil by primary depletion, an ultimate of 40% with 58 years life under gas injection, and 58% of its oil with an operating life of 68 years for water injection.

The relevant equations are given. G. D. H.

579. Study of the orifice well tester and critical flow prover. L. B. Lesem, J. J. McKetta, and G. H. Fancher. *J. Petrol. Tech.*, Sept. 1957, **9** (9), 61–4.—When data for the orifice well tester and the Bureau of Mines type of critical flow prover are compared by extrapolation to the same conditions of flow using the published tables, discrepancies are noted. Experiments have been carried out to investigate this problem. The results obtained show that the tables of the capacity of the conventional orifice well tester with conventional (thick) orifices for pressure differentials of 0–15 inches water and all ratios of D/t are valid. The coeff given by the Bureau of Mines for the conventional critical flow prover and the capacities dependent on these coeff are valid for all ratios of L/t and upstream pressures exceeding 40 p.s.i. Between these 2 pressure ranges and for ratios of L/t between 1 and 4 there is an unstable state of flow, and hence the usual tables cannot be extrapolated to give flows in this region satisfactorily. It is concluded that orifice plates designed in accordance with ASME–AGA specifications for sharp-edged orifices and used on the orifice well tester are accurate, reliable, and suitable for all rates of flow and pressure differentials likely to be met in practical gas/oil ratio work in the field. Tables are given for the range 1 inch of water to 100 inches of mercury; above the latter pressure an equation can be applied. G. D. H.

580. New calibration and conversion techniques for radioactivity logs. V. J. Mercier and W. H. Redford. *J. Petrol. Tech.*, Sept. 1957, **9** (9), 11–15.—The need for quantitative interpretation of radioactivity logs led to the development of calibration standards for both γ ray and neutron logging devices. Detector type and class were indicated on the logs, and sensitivity data were given. Thus radiation units were given on γ ray logs, and environmental units on neutron logs. The procedure for determining these units is given.

Neutron curve conversion charts were devised to give a means of comparing neutron curve responses obtained under various borehole conditions or with different types of instrument. These charts can also be used to obtain the well strata index, a measure of a property of the rock which is independent of the logging device or borehole characteristics. The steps involved in using these charts are described. G. D. H.

581. Method of formation testing on logging cable. M. Lebourg, R. Q. Fields, and C. A. Doh. *J. Petrol. Tech.*, Sept. 1957, **9** (9), AIMME Tech. Paper No. 4635, 260–7.—The tool, lowered on a logging cable, is placed in relation to the S.P. trace viewed on a screen, and then a retaining pad is forced against the well wall to form a seal. 2 perforating bullets are fired, penetrating the pad face, and permitting flow from the formation to a sample chamber of 1-gal capacity (later models have 2·75-gal and 5·5-gal chambers, the latter segregating the last gallon recovered). When the surface controls indicate that the container is full, the sealing valve is seated at the max pressure attained. At the same time the pad collapsing mechanism operates, but it is generally necessary to detach the pads from the walls by firing bullets which allow pressure equalization with the mud. The sample pressure gauge now records the mud pressure, an indication that the instrument has been freed.

In commercial use on the Gulf Coast 1000 runs between July 1955 and Sept. 1956 gave 50% of successes, and of the failures 10% succeeded on a second run. In most recoveries a positive interpretation was possible. Because of the ease of running the device has been run on more questionable sands than on good sands. Half the failures were due to ineffective pad seals on soft sands (a percussion-type sampler may be more effective; this can sample 5 sands per trip). Recoveries have been gas, oil, filtrate, and mud, singly or mixed. Interpretation of the recoveries is discussed in terms of field experience. The pressure record is important in interpreting results. Pressures are accurate to $\pm 3\%$.

The total time for running a test at 10,000 ft may be only 2 hr; a test can be made at any time, and without special conditioning; depth setting is very accurate; gas/oil ratios can be estimated; the hole is kept full of mud.

A number of field tests are discussed. G. D. H.

582. Profiling water injection wells by the brine–fresh water interface method. D. R. Holbert. *J. Petrol. Tech.*, July 1957, **9** (7), 11–16.—It was necessary to determine injection profiles in permanently completed wells with cement-lined tubing, and which had been heavily shot giving highly irregular well bores. Brine–fresh water interfaces were used with an electrical probe for detection of the position of the interface. Fresh water was injected down the annulus and brine down marcaroni tubing at carefully controlled rates. The probe was on the macaroni tubing, which was raised or lowered to locate the interface.

The accuracy of the method was dependent on accurate flow control and allowing adequate time for stabilization of the interface. For the constant interface technique it was commonly possible to locate the interface to 0·01 ft relative to other stations. Cases were noted of significant vol of water being injected into very small vertical intervals, and on some occasions these intervals were so small as to suggest fractures rather than permeable streaks. In plugging operations it may be advantageous to distinguish between fractures and permeable streaks. G. D. H.

583. Mathematical analogies of some physical phenomena and their use in the solution of reservoir problems. J. Subik. *Nafta (Krakow)*, 1957, **13**, 131–4.—Electro-integrators are capable of solving the Laplace, Poisson, and biharmonic equations, and since flow of crude is not unlike flow of electricity, many reservoir problems can be so solved. M. S.

584. Big frac in East Texas. Anon. *Petrol. Engr*, 1957, **29** (3), B117–32.—Large fracturing jobs with high injection rates were completed. Fracturing treatment consisted of sand blended with filtered salt water, and the primary injection consisted of a gel of the mixture as a precaution against a screen-out. E. A. G. H.

585. Up-dip oil recovery by down-dip gas injection. R. M. Morrow. *Petrol. Engr*, 1957, **29** (4), B28–32.—In an anticlinal structure the oil–water contact was rising and the water drive slackening. Gas injection formed a separate phase under the fault block and the risk of several wells drying up was averted. Reservoir pressure at first rose and then was maintained at a constant level. The use of gas injection eliminated the need for more drilling and increased the ultimate oil recovery by draining the up-dip region more completely than wells drilled to accomplish natural depletion. E. A. G. H.

586. Keys to effective down-well gas-separation. J. R. Brennan. *Petrol. Engr*, 1957, **29** (4), B38–41.—Bottom-hole separation of gas and oil is desirable when the well must be pumped. The separation is accomplished by gas anchors, several types of which are described, together with down-hole pumps. E. A. G. H.

587. Oklahoma's deepest production. G. M. Stearns. *Petrol. Engr*, 1957, **29** (4), B61–6.—A major gas field has been discovered in the Carter-Knox field and is producing from Ordovician sands below 15,000 ft. Directional drilling was used to take advantage of the natural strata drift. Production is amounting to 7 M.M.c.f. of gas/day, together with a liq condensate. E. A. G. H.

588. Fluctuating gas flow controlled automatically. Anon. *Petrol. Engr*, 1957, **29** (4), B53–60.—The flow from 13 gas wells in the Keller's Bay field passes through an automatic control system which keeps the gas delivery pressure constant and independent of flow rate. Safety precautions are mentioned and flow measurement is doubly checked. E. A. G. H.

589. How to design a closed rotative gas lift system. H. W. Winkler. *Petrol. Engr*, 1957, **29** (5), B35–46.—This system, with the injection gas recycled, permits the artificial lifting of many wells. The system may be designed to produce high pressure gas for sale, when excessive formation gas is produced. E. A. G. H.

590. Treating oilfield emulsions. J. L. Wiggins. *Petrol. Engr*, 1957, **29** (5), B47–56.—Some wells produce emulsions which may be difficult to break. Solutions of surface-active agents, agitation, or heat are applied to break the emulsions. Settling tanks are then required to remove the water. 2 tests are described which aid the selection of the type of emulsion treatment. E. A. G. H.

591. Soap–oil systems for formation fracturing. A. R. Hendrickson, L. E. Nesbitt, and B. D. Oakes. *Petrol. Engr*, 1957, **29** (5), B58–66.—Low sand-falling rate and low fluid loss, desirable qualities of fracturing fluids, may be obtained by soap–oil dispersions, which are finding wide application in well stimulation techniques. An organic acid is dissolved in oil and neutralized by aq sodium hydroxide, forming the micelle dispersion. At high rates of shear the visc of the dispersion falls rapidly. On heating the dispersion, greases are formed which are undesirable in a fracturing fluid. E. A. G. H.

592. Well completion programme in Lake Maracaibo. D. M. Koons. *Petrol. Engr*, 1957, **29** (6), B47–51.—The completion of underwater wells allows production by either tubing or casing flow, with gas lift on the tubing or casing. A new type of safety valve, which does not interfere with completion or producing operations, is used. E. A. G. H.

593. "Graph system" gives gas lift a lift. E. D. McMurry. *World Oil*, 1957, **145** (5), 216.—It is shown that the use of the

subsurface plunger with "stopcock" and intermitting gas lift wells can have advantages, particularly where production is less than 100 b.d. The applications of the plunger method are described for wet gas wells, high ratio wells, standard intermitting gas lift, and for wells with high bottom hole pressure and low productivity index. A 2-string plunger system has been successfully used in California, where a vacuum is applied to the casing of wells with low bottom hole pressure but good productivity index. Diagrams show the operation of the installations. C. A. F.

594. Recent developments in hydraulic fracturing. E. J. Coel. *World Oil*, 1957, **145** (5), 205.—Lab and field developments have resulted in considerable improvements in hydraulic fracturing since the method was introduced, and some of the recent developments in techniques are reviewed. In particular, the sand/water mixture is being increasingly used, and it has the advantage of safety, and low cost. The sand-carrying characteristics are almost as good as those of refined oils; but a disadvantage is that emulsions may form with oil in the beds, and heaving shales can occur.

Various sealing agents have been used to give temporary seals to isolate zones during treatment, *e.g.* the ball sealer used with perforated casing which can eliminate a bridging plug.

At the surface collapsible tanks are being used to store the fracture water, together with plastic-lined earth tanks.

Examples of fracturing treatments in the San Juan basin of New Mexico are given to illustrate various techniques now in use. 4 refs. C. A. F.

595. A universal theory of oil reservoir engineering. Pt 2. Production of oil by segregation drive and combination drive. S. J. Pirson. *World Oil*, 1957, **145** (5), 209.—The mechanics of segregation drive (with and without counter flow) and combined depletion-water-segregation drive (with and without counter flow) are described and equations are presented to give the overall recoveries of each method.

Diagrams illustrate the nature of the processes, and it is shown that if segregation drive can be favoured in a field, oil recoveries can be very high, with or without oil and gas counter flow. C. A. F.

596. How does theoretical gas well performance compare with field data? J. S. Miller. *World Oil*, 1957, **145** (5), 222.—The treatment of unsteady-state gas flow based on Darcy's law does not explain fully the behaviour of gas wells and further studies of gas flow are required, since non-viscous flow may be an important factor. Recent published work on the problem is listed and briefly reviewed; the theoretical methods of Aronofsky and Jenkins, for example, give results which differ from actual well performance in the amount of "slope" of the back-pressure curves.

Back-pressure curves have been computed, based on the Aronofsky equations, applying the principle of superposition. These curves are given and it is shown that the results indicate complicated transient conditions in the reservoir which may cause some deviations from unity of the back-pressure curves. 17 refs. C. A. F.

597. Modern well completion methods in U.S.A. A. L. Solliday. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 59–73.—This paper presents a review of modern well completion methods in the U.S.A., with special emphasis placed on the most recent developments. These include: (1) recognition and determination of the permeability impairment often incurred during drilling-in and perforating operations and partial elimination of this damage by the use of special drilling fluids; (2) development of methods and tools to eliminate need of a drilling rig during completion operations; (3) improved acidizing and chemical treating techniques through the use of additives and surfactants; and (4) refinements and new applications of hydraulic fracturing which include large vol fracturing, fracture placement, improved propping agents, and special fracturing fluids. The importance of these developments to the oil industry is discussed. Criteria are offered which aid in selecting the best methods for various reservoir conditions encountered.

(Author's abstract.)

598. Oil well gravel packing operations in Trinidad. A. S. Curlet and R. Pike. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 75–90.—The background history and recent development work with gravel packing as a completion and repair technique for Trinidad oil wells is described. The success of gravel packing, 0·04–0·06-inch "gravel," in controlling typical unconsolidated fine grained Trinidad Miocene producing sands, is claimed to have been established. Development is described of a gravel pack completion recommended as a standard completion method for new wells exploiting thick low productivity sands in areas where troublesome formation movement is to be expected. Results of remedial gravel pack operations carried out in existing troublesome wells are given to illustrate the benefits achieved. Whilst the experiences reported support the desirability of gravel packing with only solids-free fluids in circulation, satisfactory results have been obtained using oil base mud, in operations where weighted fluids are required for pressure control.

(Authors' abstract.)

599. Average reservoir pressure. D. R. Horner. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 131–53.—It is believed that conventional methods for determining mean reservoir pressure are incorrect in that they ignore the existence of localized pressure sinks surrounding the producing wells. In consequence, the quantity of oil initially in place in a reservoir will be over-estimated if it is derived from the material balance equation using a conventionally determined mean reservoir pressure. The report therefore treats the material balance equation as a single functional relation connecting 2 unknowns (tank oil initially in place and mean reservoir pressure) and derives a second relation connecting these same 2 quantities, based on observed bottom hole pressures and including a correction term for the effect of the pressure sinks. Both functional relations are plotted on the same graph, and the point of intersection of the 2 curves gives values for the tank oil in place and the mean reservoir pressure. An example is given of the application of the method, which is at present restricted to reservoirs with no initial gas-cap and no appreciable water-drive.

(Author's abstract.)

600. Recovery increase by "thermal drive." J. van Heiningen and N. Schwarz. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 299–312.—The possibilities of "thermal drive," *i.e.* the heating of an oil reservoir in order to decrease the visc of the crude and consequently increase recovery, are discussed. An attempt is made to answer questions such as: "What are the present aspects of increasing recovery by thermal drive?" "What heating methods are best suited for the purpose?" "Can the method be applied in an economic way?" By comparing the increase in recovery obtained by a given, uniform rise in temp of solution gas drive reservoirs with that obtained by the same rise in temp of water drive reservoirs, it is shown that solution gas drive fields offer no prospects for heating methods; water drive fields, on the other hand, offer prospects, provided the oil/water visc ratio is high enough. A survey is given of possible heating methods. One example is worked out in some detail. From the results it follows that

hot water flooding may economically increase the recovery by 50–70% or more if a cheap source of energy, in certain areas for instance natural gas, is available. (Authors' abstract.)

601. Study of *p–v–t* relations of reservoir fluids. W. R. van Wijk, D. A. de Vries, and H. A. C. Thijssen. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 313–24.—It is suggested that standard lab tests are carried out to determine *p–v–t* data of reservoir fluids instead of trying to imitate actual behaviour in a reservoir during production. The standard test should enable calculation of *p–v–t* data, especially the total vol of gas and liq for various production practices. The fraction of gas flashed off a reservoir fluid when the pressure is decreased is calculated. No equilibrium constants are used at high pressures. Fluid vol and gas vol are calculated with the aid of existing correlation methods, and if the bubble point pressure is known, the *Y* factor of the reservoir fluid can be calculated with a degree of inaccuracy of approx 10%. If a differential vaporization test is carried out in the lab, flash vaporization can be calculated from it with a degree of accuracy which is estimated at approximately 2%, and, conversely, differential vaporization can be calculated from a flash test to the same degree of accuracy.

(Authors' abstract.)

602. Recent application of reservoir treatment in Venezuela. J. W. Butler, Jr. *et al. Proc. Fourth World Petrol. Congr.*, 1955, **2**, 325–42.—The chemical and physical treatments of oil-bearing formations in order to increase well productivity are discussed in the light of recent techniques and results in Venezuela. The subject covers types and combinations of formation fracturing, acidization, and injection of specific chemicals designed to modify the characteristics of the reservoir rock or the contents of its pores. Discussion is presented regarding the treatments used in different kinds of reservoirs. Statistical data and graphic illustration are included to indicate the relative effectiveness of formation treatment. Results and trends are evaluated on the basis of practical application in Venezuela oilfields. (Authors' abstract.)

603. Problems of very heavy oil production in California. J. J. McCullough. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 353–69.—Problems connected with the production and subsequent handling of very heavy, 6°–12° API oil in the coastal region of California are of both physical and economic origin. The physical properties of produced fluid and the subsurface reservoirs are not completely known at the present time, but existing data are discussed. Typical drilling and completion programmes are given. A review is made of production problems and the present equipment and techniques used in the solution of these problems. Treating, handling, and transportation difficulties are outlined briefly, together with some of the economic problems of very heavy oil and certain factors influencing the present selling price and possible future market in California.

(Author's abstract.)

604. Flow in fissured formations. W. J. Baker. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 379–93.—Equations are given for parallel and radial flow in a uniform horizontal fissure under both streamline and turbulent conditions. Experiments with an artificial fissure are described and the results applied to the estimation of the range of fissure sizes encountered in a limestone reservoir. The migration of oil and the productivity of wells in a fissured formation is considered and a comparison made between the behaviour of fissured and unfissured reservoirs. Methods of increasing production from both types of reservoir are discussed, with particular reference to acidization and formation fracturing. The influence of fissures on reservoir vol is considered, and a method of detecting fissures is described.

(Author's abstract.)

605. Effect of production restriction on Iranian oil reservoirs. W. J. Graham *et al. Proc. Fourth World Petrol. Congr.*, 1955, **2**, 395–416.—In 1950 and the first half of 1951 the oilfields of SW. Iran had a potential of some 700,000 b.d. and were producing at nearly that rate. In mid-1951 the fields were nationalized, and the production was reduced to less than 20,000 b.d. The fields remained nearly closed-in until late 1954. This nearly complete restriction of production produced only minor changes in conditions in the reservoirs. The Asmari limestone, which is the important reservoir rock in all 6 fields, is usually well fissured. Only small pressure differences existed between different parts of the reservoir when the fields were under production. With the fields nearly shut in these differences tended to disappear. There were also small increases in average pressure. 2 of the fields, Haft Kel and Naft Safid, have weak water drives. In these fields the pressure build-up was still continuing slowly in 1954. A third field, Masjid-i-Sulaiman, has a feeble, but still appreciable, water drive. In the 2 largest reservoirs, Agha Jari and Gach Saran, water influx is apparently negligible. Pressure build-ups were only small fractions of total pressure drops since production began, and were complete within the limits of observational error in 2 years or less. In the Lali Asmari reservoir pressure build-ups were larger. This reservoir is less fissured than the others and is largely undeveloped. Observed increases in pressure may have been largely the result of internal adjustments rather than water influx. In Haft Kel and Masjid-i-Sulaiman, where fluid levels can be fixed with some precision, there was a net average rise of both the gas–oil and oil–water levels. In these 2 fields, and apparently in Naft Safid, the reservoir vol between the 2 interfaces increased. There seems to have been continued drainage from the rock matrix above the gas–oil level of the fissure system, flushing from the matrix below the oil–water level of the fissures, or both.

(Authors' abstract.)

606. Correlation of ultimate oil recovery with reservoir characteristics. S. E. Buckley. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 417–24.—The recovery of oil from a particular deposit is not a fixed quantity but depends on the method employed to recover the oil and on the skill with which the method is used. The application of technology to the recovery of oil requires, therefore, a comprehensive appraisal of each particular reservoir, the selection of a suitable recovery process, and control of the selected recovery process for the duration of production. This paper describes the manner in which a reservoir may be appraised and the proper recovery process selected. (Author's abstract.)

607. A theoretical investigation into the recovery of oil from fissured limestone formations by water-drive and gas-cap drive. J. Birks. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 425–40.—A fissured limestone formation is considered as blocks of oil-containing limestone of low permeability separated from each other by fissures which offer a negligible resistance to fluid flow. The dynamics of oil displacement from the blocks by water or gas-drive have been studied first by an idealized capillary model, and secondly by a simple relative permeability model. Typical examples are shown graphically of the effect on the rate of oil recovery of changes in fluid and rock characteristics. The merits of water-drive and gas-cap drive are discussed. (Author's abstract.)

608. Study of volumetric behaviour and conditions of hydrate formation of a natural gas containing a large proportion of hydrogen sulphide. R. Molinero and R. Fagegaltier. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 549–59.—A study of the volumetric behaviour and conditions of hydrate formation of natural gas from the " Lacq Profond " gas field, which contains *ca* 18% H_2S and 8% CO_2, is presented. Experimental work has been carried out at pressures covering the range 0–700 kg/cm² at temp up to 150° C. A *p-v-t* equipment—perfectly corrosion resistant—which ensures personal safety and sound results has been constructed. R. T.

609. First offshore microwave system. C. R. Graham. *Petrol. Engr*, 1957, **29** (6), B33–6.—Communications with no interference in all weathers between the shore and installations 55 miles away in the Gulf of Mexico are being established by a microwave system. Production from 3 fields may be controlled automatically and the system is capable of expansion. Maintenance has been simplified by a series of safety and warning controls. E. A. G. H.

610. New instrument for measuring bulk and grain volumes. W. L. Russell. *J. Petrol. Tech.*, July 1957, **9** (7), 51–3.—The pyknometer consists of a glass bulb with a tap at the top and 2 parallel capillary tubes connecting at the bottom to a larger container in the form of a ground glass joint with an external cap which has a drain tap set in the side at its base. A permanent mark is etched on the capillaries, and in use a second mark is made to allow for small losses arising when the joint is broken and re-made. The latter mark is obtained by inverting the apparatus, putting in liq to fill most of the apparatus, then returning it to the normal position after making the joint. The liq is drained down to the permanent mark through the lower tap. Invert, open joint, remake joint, and return to the normal position, and then the liq meniscus shows the position for the temporary mark.

To measure the vol proceed as above, but insert the specimen at the point where the apparatus is opened after draining to the permanent mark. Close, return to normal position, and drain down to the temporary mark, collecting and weighing the displaced liq.

Mercury and other liq can be used. Comparisions have been made with 2 modifications of Nutting's method. All the methods are reasonably quick, and the probable errors of bulk vol can be kept down to *ca* 0·1–0·2%. G. D. H.

611. Casing programme. H. Blum. *Petrol. Engr*, 1957, **29** (4), B72–94.—Types of casing and their characteristics are described. Casing may fail due to excess internal or external pressures, or to tension. Detailed procedure is given for the design of casing and is illustrated by examples. A routine of inspection and proper handling of the completed casing is proposed to obtain optimum performance. E. A. G. H.

612. Placement of subsurface pumps. O. Snow. *Petrol. Engr*, 1957, **29** (5), B96–104.—A graphical method to properly re-locate subsurface pumps has proved successful in high fluid amount producing wells in Kansas. Production has increased, pump efficiency has improved, and pump depreciation lessened for very little cost. E. A. G. H.

613. How to reduce pump thrust bearing loads. C. McFarland. *Petrol. Engr*, 1957, **29** (5), C4–5.—Removal of part of the rear shroud on single suction impellers of process pumps has resulted in reduced thrust loads, which lessens the possibility of thrust bearing failure when operation near the shut-off condition is frequent. E. A. G. H.

614. Dual concentric tubing strings designed for corrosion control. P. R. Hillegeist. *World Oil*, 1957, **145** (5), 228.—The method of completion of a gas-dist well in the Ridge field, Louisiana, is described. The well was dually completed with concentric tubing strings in order to combat corrosion, attributed to such factors as organic acid and salt water in the produced fluid, and to its high velocity in the tubing.

Dual 2⅞ inch o.d. tubing strings with 1¼-inch plastic coated tubing inside were used and a special christmas tree was required, the details of which are shown in diagrams. Provision was made for injecting chemical inhibitors. Completion is in the Discorbis zones below 10,000 ft.

In some other wells in the area which have single zone completions, corrosion treatment is by chemical injection into the annulus of a concentric tubing string. C. A. F.

615. Economics fosters dual completions. F. C. Prutzman. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 79–82.—Since 1949, the petroleum industry, looking in all directions for means and methods of economizing, has developed and employed the dual completion to great economic advantage. By use of special tools and techniques, 2 wells may be completed and satisfactorily produced through a single well bore. In the great W. Texas area, initial investment savings, one dual *v.* 2 single wells, range from $13,000 at a 2000-ft depth to $90,000 at a 10,000-ft depth. Despite the great advances in equipment design and techniques, the dual completion has not yet been developed to the point where it offers the same operating flexibility as 2 single wells. Unless the particular producing conditions are right, the later-life increased operating expense of the dual may more than offset the initial investment advantage. A prudent operator will weigh all advantages and disadvantages carefully before he selects his course of field development. Indiscriminate application of the dual technique to any and all multiple zone fields can lead to later-life development. (Author's abstract.)

616. Automatic lease production, Wasson field, Texas. R. L. Geer and D. C. Meyers. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 83–99.—This is an automation era. Generally speaking, industry as a whole has turned to the application of automatic controls and instrumentation to perform complex and exacting functions as well as routine everyday jobs which were formerly executed by manual methods. The application of automation to manufacturing facilities of refinery and pipeline operation has effected a vast increase in operating efficiency and product quality while greatly reducing operating costs. Realizing that other branches of the petroleum industry had benefited greatly from the application of automation to their operation problems, Shell Oil Co., Midland area, initiated a study in 1950 to determine what means or methods could be devised, through engineering research and development, to increase operating efficiency and to reduce the actual manpower requirements necessary to perform the various routine functions of oil and gas production. This paper briefly reviews the techniques, equipment, and automatic lease designs which have been developed to increase the efficiency of oil and gas production operation in the Wasson field, Yoakum and Gaines Counties, Texas. Experience gained from the automatic lease installations in the Wasson field has indicated the feasibility of automation in field-wide production operations. Eventual acceptance of automatic lease equipment and techniques, now being developed for automatic oil and gas production, will allow the petroleum industry to enjoy worthwhile savings and increased revenues through the application of the most modern techniques and the more efficient utilization of personnel. (Authors' abstract.)

617. Packaged lease automatic system controls production. Anon. *Petrol. Engr*, 1957, **29** (5), B134–9.—Full lease automation from well-head to pipeline is available in a packaged system including well-head shut-in, well test control, well

flow control, tank switching, custody transfer, fluid metering, and lease safety controls. Accuracy, elimination of routine procedures, greater efficiency, and reduced operating expenses are obtained. E. A. G. H.

618. Methods and devices for locating the zone of lost circulation. C. F. Gallagher. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 113–18.—Restoring mud flow after circulation has been lost is facilitated if the exact zone of lost circulation can be determined. Several devices to determine the zone of lost circulation are available. Notable among these are: (1) the temp survey, depending upon the difference in mud temp and formation temp; (2) the lost circulation device, which measures the flow of a slug of fluid ejected into the mud column; and (3) the fluid velocity indicator, which indicates the flow of fluid in the drill hole by causing the flow to create a pressure differential within the device. The advantages and disadvantages of each device are presented.
(Author's abstract.)

619. Widening interest in the Sahara. Anon. *Petrol. Press Serv.*, 1957, **24**, 363–5.—Over 60,000 km² in the Sahara revert to the Government this month, on the expiry of the 5-year period of permits held by SNREPAL and CFP(A). The 190,000 km² to be surrendered in 1958 by these companies and CREPS and CPA brings the total to be given up in 1957–58 to 250,000 km². The important Hassi Messaoud find in 1956, smaller fields bordering on Libya, and large natural gas reserves make the Sahara attractive to petroleum explorers. Lively financial interest in Saharan and Metropolitan oil prospects is shown by the applications for search permits by new foreign entrants associated with French groups. Foreign companies must be associated with French groups, and must have a capital holding $\not>50\%$. Algeria, including the Sahara, is subject to the same attractive basic mining legislation as Metropolitan France. Capital is required to meet the estimated Fr. 250 milliards expenditure for search, development, and pipelines. By 1960 annual production from the Sahara might reach 14 million metric tons. Further Fr. 100 milliards investment might lead to 25 million tons p.a. in 1962. The French Government is to raise funds against its own share holdings. Development financing in the Sahara is subject to political conditions. The latest attempt to find a solution, the draft *Loi Cadre*, providing for a federal system of government, with Algeria divided into 6 regions, brought about the French Government's fall. R. T.

620. Slower progress in Uruguay. Anon. *Petrol. Press Serv.*, 1957, **24**, 374–6.—While essentially a pastoral country, Uruguay has become increasingly industrialized, with continual encouragement from the Government. After a period of overspending Uruguay is having to retrench. New exchange regulations introduced in 1956 aim at restricting imports of non-essential goods. In consequence of tighter control a surplus equiv to U.S. $5·3 million in her trade balance last year replaced an adverse balance of U.S. $42·3 million in the previous year. Uruguay has few resources and must import machinery and equipment for her expanding industries, also much of the fuels. There is no coal in the country, and so far no petroleum has been discovered. ANCAP, the state entity, has a monopoly of local oil exploration, production, and refining, also crude oil import and refining, and distributes ⅓ the total market needs. Last year's inland petroleum consumption, *ca* 1·2 million metric tons, included 480,000 tons of fuel oil. Although hydro-electric resources are being developed still, drought makes hydro-electricity an irregular and uncertain source of energy with an influence on fuel oil requirements. Shell, Esso, and Texas distribute, supplying crude to match their sales, and importing such of their needs as the refinery is unable to supply at present. ANCAP's La Teja refinery, Montevideo, with a present total of 25,000 b.d. throughput capacity, is being expanded and modernized. R. T.

621. The cost of plenty. R. L. Heilbroner. *API Quart.* Summer 1957, 14–19.—A review—based on the Chase Manhattan Bank's revision of the 1956 study—of consumption, necessity to plan for future requirements, future needs, sources, and cost of petroleum production in the U.S.A. and the Free Foreign World. By 1965 U.S. petroleum consumption will be 13 million b.d., *ca* 80% > in 1955. That of the Free Foreign World will be equal to or > that of the U.S.A. This will represent an increase of more than 100% in the Free Foreign demand for oil. The daily average consumption of petroleum products by the U.S.A. + the Free Foreign World will by 80% > 1955 levels. The Free World will have to produce more oil within the next decade—71 billion brl—than the whole U.S.A production up to 1955. This can be done but at a cost of $115 billion. By 1975 the U.S.A. will be using *ca* 20 million b.d. of petroleum, the Free Foreign World > 27 million b.d. at a cost of > $200 billion. This task is possible. In 1918 petroleum supplied *ca* ½ of U.S.A. energy consumed, in 1955 65%. Various estimates put U.S.A. petroleum requirements at 12·8 million b.d. for 1965 and 20 million b.d. for 1975. For the Free Foreign World from < 6 million b.d. in 1955 demand would reach 12 million b.d. by 1965 and 27·5 million b.d. by 1975. For the whole of the Free World the totals are 25 million b.d. within 10 years, and *ca* 50 million b.d. in 20 years. A cumulative consumption figure would be 71 billion brl of oil between 1956 and 1965. From two to three times as much oil awaits discovery as was estimated 15 years ago. As oil and gas production have increased, so has the vol of proven reserves. The gloomy picture is illuminated by the discovery of huge offshore fields. Each offshore well adds to reserves *ca* 9 times as much oil or gas as the average well drilled on shore during approx the same period. Further estimates of reserves are based on only 40% recovery. Other reserves, shales, tar sands, and coal must be considered. A total reserve estimate of 300 billion brl in the U.S.A. and Continental shelves is considered reasonable, but costs increase disproportionately as drilling depth increases. The critical factor is the capital cost of petroleum, which will call for a vast unprecedented financing effort by the petroleum industry. R. T.

622. The terminology of petroleum reserves. F. H. Lahee. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 561–5.—In order to avoid confusion in the presentation of data on reserves of petroleum and natural hydrocarbon gas, the recommendation is made that a standardized terminology be adopted and particularly that authors, speakers, and estimators within this field of study always clearly explain the exact significance of their figures. A method of classifying reserves is outlined in detail. (Author's abstract.)

623. The API model form of unit agreement and unit operating agreement. H. F. Beardmore. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 41–2.—Agreement forms are now available which will expedite the unitization of oilfields by reducing the negotiating time. Oil and gas fields are unitized principally for conservation purposes, and the early installation of recovery programmes associated with units usually results in additional recovery of oil and gas. There are 3 basic types of unit agreements. The one requiring the most negotiation is for an entire field. There are now in excess of 300 pool-wide units, and approx 30 of this type are being organized yearly.
(Author's abstract.)

624. Reduce costs through methods analysis. R. C. Filson. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 100–3.—Operations

can be efficiently planned by the study of the methods, tools, and equipment used in accomplishing the activities of each job. Methods analysis is a means to improve work procedures, eliminate hazards, and improve employee–supervisor relationships. With the employment of methods analysis, more effective co-ordination of working groups, better planning of operations, and more effective utilization of manpower and equipment can be accomplished. This paper discusses methods analysis and some of the economies achieved through its use on lease producing operations.

(Author's abstract.)

625. A short analysis of hydrodynamic processes in mud-pump delivery piping. R. Plavec. *Nafta* (*Yugoslavia*), 1957, **8** (9), 293–301.—The author gives a mathematical analysis of kinematic and dynamic processes which take place in delivery pipings of mud reciprocating pumps. First of all these processes are analysed in pumps without an air chamber; non-uniform liq flow and damage to the pump and pressure piping system caused by such a flow are examined. A figure shows the velocity curve in the pressure pipe in correlation with the angle, and the curve is discussed. The acceleration and inertia strength, as well as their influence on the delivery pressure, are analysed. The influence of non-uniform liq flow on friction losses in pipes (and vice versa) and on the pump delivery are also analysed In the article similar analyses are given for pumps with non-pressure air chamber and for pumps with pressure air chamber, together with their respective advantages. As an example the analysis of the working of a normal duplex pump $7\frac{1}{4}$ inches $\times$ 16 inches, with 40 rev/min in various cases has been given.

(Author's abstract.)

OILFIELD DEVELOPMENT

626. SACROC unit operations. H. H. Allen and C. T. LaRue. *J. Petrol. Tech.*, July 1957, **9** (7), 21–5.—The Kelly–Snyder field of Scurry County, Texas, has 2800×10^6 brl of oil, but early performance suggested a primary recovery of only 670×10^6 brl. The SACROC unit was created to undertake pressure maintenance. There is no adequate natural water drive. Water injection was made through wells along the axis of the field. The less efficient edge wells were shut in. Injection is into the thickest part of the reef.

4 years of primary production had dropped the reservoir pressure from 3122 p.s.i. to *ca* 1540 p.s.i. when water injection began in Sept. 1954. Water is from a lake 20 miles away, and a plant was built to treat and inject 200,000 b.d. with a discharge pressure of 2340 p.s.i. A tower is being built to remove *ca* 11 p.p.m. of entrained oxygen which causes corrosion.

To date injected water has been produced from 72 out of 181 offset producing wells. Most premature breakthroughs have been controlled satisfactorily. The pressure had built up to 1745 p.s.i. in Jan. 1947, while there had been an overall drop in producing gas/oil ratics during water injection. At that date the cumulative oil production was 179,173,387 brl; the gas was 186,866,939 M.c.f., and the water 8,745,285 brl. The SACROC unit had given 78,836,303 brl of oil, and had injected 110,464,667 brl of water. The performance as a whole is satisfying. G. D. H.

627. Adventure at sea. H. A. McKinley. *Petrol. Engr*, 1957, **29** (6), B105–28.—Offshore oilfield operations in the U.S.A. are reviewed and legal problems discussed. The small return for large investments has created a demand for increased production at lower cost. The seriousness of the future development and exploration situation is underlined.

E. A. G. H.

628. Offshore offers best results. I. H. Cram. *Petrol. Engr*, 1957, **29** (6), B21–3.—Many fields have been discovered off the coast of the U.S.A., most of them on Louisiana leases. The proportion of wildcats off Louisiana which produces is much higher than the national average; however, this may be due to drilling of the most attractive prospects. Drilling off Texas has been less successful. At the beginning of 1957 cumulative production of crude oil and condensate was 110 million brl and cumulative natural gas sales were $\frac{1}{4}$ billion cu. ft. On 1 Sept. 1956, a reserve of *ca* 620 million brl of crude oil and condensate and over 4 billion cu. ft. of natural gas was estimated. So far, only about 10% of the original investment has been recovered, so that rapid development at lower cost is required. E. A. G. H.

629. T.G.T.'s 26-inch line threads its way into the Gulf. E. Sterrett. *Pipe Line News*, Oct. 1957, **29** (10), 21–4.—For laying this 26-inch pipe a distance of 25 miles into the Gulf of Mexico, a new type of laying barge is being used. This barge is 300 ft long by 60 ft wide, and is specially designed to allow the pipe and concrete coating to be lowered to the sea bed without overstressing. Details of the barge and the method of construction are given. D. K. R.

630. Canada has its biggest year. H. G. Cochrane. *Petrol. Engr*, **29** (5), E3–6.—The petroleum industry of Canada achieved a production record of 170,600,000 brl for 1956. Production of natural gas showed an $11\frac{1}{2}\%$ gain over the previous year. 3300 wells were drilled to completion and discoveries increased proved reserves to over 3,500,000,000 brl. The number of producing wells was *ca* 9000 at the end of 1956 and probable reserves of natural gas increased to *ca* 23 billion cu. ft. Total refinery potential capacity was 708,000 b.d. During 1956, 3100 miles of gathering and distribution lines were laid. Exports of crude attained an annual rate of 44,000,000 brl, nearly 3 times the total for 1955, partly due to the Suez Canal closure. A large-scale attempt is being made to develop the large oil deposits in the Athabasca tar sands. Offshore drilling on the Great Lakes has produced new reserves of natural gas. E. A. G. H.

631. Canada's Pembina field. J. J. Juster. *J. Petrol. Tech.*, Sept. 1957, **9** (9), 21–6.—The Pembina field, discovered in 1953, now has 1750 producers on 175,000 acres out of an estimated total of 400,000 acres. Currently it gives over 110,000 b.d. It is in a wedge-out of the Cardium sand at depths of 4600–5800 ft. The dips are 30–60 ft/mile to the SW. The main sand is up to 25 ft thick; this is separated by *ca* 20 ft of shale from the 10–15 ft thick lower zone of lenses. The average porosity is 14·4% (max 29%); interstitial water is 10·5% and permeability may attain 100 mD. Saturation pressures have ranged 1433–2666 p.s.i.g. solubilities 382–933 cu. ft/brl, formation factors 1·188–1·48, and subsurface visc 1·408–0·636 cP, while the oil gravity averages 37° API. It seems that much of the reservoir initially has less than 500 cu. ft gas/brl, suggesting a saturation pressure of 1700 p.s.i.g., and hence probably original undersaturation.

Nearly every well has to be fractured to produce commercially. Natural productivity indices are estimated at 0·148 b.d/p.s.i.; after fracturing the indices of a number of wells averaged 0·47 b.d/p.s.i. Pressure build-up is slow in wells, and a month's shut-in may be needed. Pressure sinks exist where early development was concentrated.

The natural recovery mechanism is by dissolved gas drive. Detailed reports analysing portions of the reservoir have indicated primary depletion recoveries of 13·1, 18·3, and 13%. A generalized study on 200,000 acres divided into 20 parcels gave figures of 3·6–17·2%; the average was 12·5%; oil in place was $3{\cdot}19 \times 10^9$ brl.

Using a water-flood on a 160-acre, 5-spot pattern the

detailed studies predicted recoveries of 43·1, 42·6, and 30·2%. Based on these studies it was considered that 125,000 acres could be flooded, the recovery factor being 37·5%; a further 110,000 acres were expected to give 7·6% by primary depletion.

Water injection began in April 1956, and by the end of 1957 50,000 acres is expected to be involved. The average injection rate is 200–300 b.d. at pressures of 400–1500 p.s.i.g. 80-acre 5-spots are used. In cases reported the producing gas/oil ratio has declined after an initial rise, and has stabilized at the normal 400 cu. ft/brl, with less than 45,000 brl of water injected. In some cases heated water has been injected. It appears that the N. Saskatchewan River will be the main source of water. As much as 200,000 b.d. may be injected.
G. D. H.

632. $50 million Athabasca development. Anon. *World Petrol.*, 1957, **28** (6), 65.—Following 2 years' intensive study of an economical means of separating the oil from the Athabasca tar sands in Alberta it is planned to develop a centrifuge process which has been carried out in a pilot plant in the area. Initial plans involve an investment of $50 million and include a separation plant and a process plant which will handle 20,000 b.d. The property of the company operating the scheme has an estimated potential of 1 billion brl oil. Total reserves of the sands are estimated from 100 to 300 billion brl, and many earlier efforts of extraction, involving washing processes, were unsuccessful economically.

In the new process the sand is spun from the oil, which will then be sent to a sulphur extraction plant before being piped.
C. A. F.

633. Copters triple output of exploration party in Papua. A. B. Malone. *World Oil*, 1957, **145** (5), 235.—Exploration operations in W. Papua are discussed. Communications and transport present difficult problems because of variable terrain, ranging from deltaic swamp to bush and jungle. There are no roads, and basic transport is along rivers, with helicopters being increasingly used. Remote locations are served by air drops.

Geophysical parties under these conditions rarely exceed an output of 10 miles/month, and observations require great detail because of the low velocity weathered layer, which is very variable in thickness. In recent operations large-scale refraction reconnaissance has been followed by reflection work, using 2 parties. The technical and operational difficulties are considerable.
C. A. F.

634. Achievements of petroleum industry in 1956. K. Mischke. *Nafta* (*Krakow*), 1957, **13**, 120–3.—In the Carpathians a few shallow deposits have been discovered and the ratio of drilling to production from that region remains at 1·4 t/m. No new fields have been discovered by deep drilling, but there are still chances that they will be found. Beyond Carpathians the aim is for more general information, although a gas field in central foothills from non-Miocene formation has been found. In the N. a likelihood of oil has been suggested in Zechstein formations. Drilling totals are: geolcgical drilling 20,855 m (79% plan), exploratory drilling 43,077 m (104% plan), production drilling 16,268 m (90% plan), special drilling 376 m (11% plan). Only 3·5% of that was by percussion drilling. Total drilling, including that done by the "Carpathians" Enterprise, which uses percussion method in 9 cases out of 10, reached 84,233 m. Crude produced in Poland reached 183,687 tons and imported crude 548,000 tons, whereas imported products came to 959,000 tons. "Gas plan completion" (gas through strippers) was 135 million m^3, and total gas produced reached 434,920·54 million m^3. In the IP 94 out of 122 problems dealt with have been solved and in the Central Laboratory of the Petroleum Industry work on geology of the lowlands is proceeding.
M. S.

TRANSPORT AND STORAGE

635. Firmer tank foundations. C. H. Chilton. *Chem. Engng*, Oct. 1957, **64** (10), 152.—An American method of dealing with soft subsoil is described. The method, that of preloading with heavy mounds of sand, has previously been used only in highway construction.
P. J. O.

636. Chemical cleaning of storage tanks. L. E. West and B. L. Canaday. *Petrol. Engr*, 1957, **29** (5), C16–19.—Removal of sludge and scale deposits from refinery storage tanks is accomplished by chemical solvents applied with specially designed mechanical tools which improve the effectiveness of treatment. The use of gelled solvents increases reaction times and eliminates solvent recycling.
E. A. G. H.

637. Installation extension at Djibouti petroleum port. Tank shifting by flotation. M. Rocher and M. Tschopp. *Bull. Ass. franç. Tech. Pétrole*, 1957, 385–95.—Account (photos and plans) of moving (*ca* 1 km) 2 tanks (5000 and 700 tons) involving both overground transfer and flotation to site.
V. B.

638. Trends in loading and unloading tank trucks. C. M. Gardner. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 217–21.—Safety and economy of operation determine the trends in tank-truck loading and unloading. Sohio achieves its objective in this field by considering every factor that will make the operation faster, cheaper, and safer. The only qualification is that no single item of speed, economy, or safety be stressed at the expense of the other two. Continued application of these principles to overall design and layout of tank-truck loading terminals has resulted in many tangible improvements. The author predicts that bottom loading of tank trucks will eventually be standard practice. Progress in this direction is slow because of the cost of dual loading facilities during the conversion period and the fact that existing techniques require a relatively high investment per truck for the savings produced. The trend towards bottom loading may be hastened by legislation requiring complete vapour recovery as an air pollution control measure. Tank-truck unloading speeds may be improved by aux pumping equipment or an increase in the number and size of dump hoses. Also, there is a trend towards the use of tight connexions between tank-truck and underground dump tank, in as much as they improve loading rates. Here again, municipal legislation requiring this technique accelerates the trend. Time savings in truck loading and unloading will be the most important factor influencing trends that are already established.
(Author's abstract.)

639. Developments in Milford Haven. Anon. *Inst. Petrol. Rev.*, 1957, **11** (130), 280.—Preliminary work at Popton Point, Pembrokeshire, is described, and future developments at Angle Bay and Kilpaison Farm are outlined.
G. A. C.

640. 8000 b.h.p. turbocharged Hawthorn-Doxford engine for Shell tankers. Anon. *Mot. Ship*, 1957, **38** (450), 343.—The shop trials for this engine have just been run. It is designed for max continuous rating of 8000 b.h.p. at 115 rev/min.

The engine has 6 cyl with a 650-mm bore and a 2320-mm combined stroke, the corresponding max and mean indicated pressures being *ca* 780 p.s.i. and 108 p.s.i. respectively. D. K.

641. The supertanker *Höegh Fair*. Anon. *Mot. Ship*, 1957, **38** (450), 356.—The vessel is 33,091 metric tons and has 12,300-b.h.p. turbocharged single screw machinery. The engine has 10 cyl, the normal rating being 12,300 b.h.p. at 115 rev/min. The cyl dia is 740 mm and piston stroke 1600 mm, and it operates on heavy oil. Diagrams and photographs of the vessel are included. D. K.

642. Trials of a 33,500-ton diesel engined tanker. Anon. *Mot. Ship*, 1957, **38** (450), 347.—Further details of the 15,000-b.h.p. single screw motor ship ***Yuyo Maru No. 5.*** D. K.

643. Underground gas storage in Roztoki formation. H. Gorka and R. Stepek. *Nafta (Krakow)*, 1957, **13**, 98–103.—The gas storage carried out in Roztoki formation was intended to absorb summer surpluses. Work was done by J. Kaczorowski and W. Kolodziej from June 1954. Results for 14 months are tabulated with regard to several wells, whilst the gas was being pumped in, and later over 12 months when it was being pumped out The interesting feature is that 10¼ million m³ of gas was pumped in at 8·1 atm excess pressure, whilst only 7⅝ million m³ of gas was recovered. This was due to pressure fall of 1·9 atm. M. S.

644. Energy by pipeline. Anon. *Petrol. Press Serv.*, 1957, **24**, 369–72.—An almost universal acceleration in pipeline construction exists. The free world's total mileage is over 300,000 miles of trunk oil and natural gas pipelines, of this *ca* 240,000 miles are in the U.S.A. Trunk lines under construction or planned, in all parts of the free world outside the U.S.A. total *ca* 14,000 miles. In the U.S.A. pipelines expected to be completed this year total *ca* 15,000 miles. New areas in the Sahara, Persia, Assam, Argentina, etc., await pipelines for their development. The explorer resorts increasingly to less accessible regions from which transport depends on pipelines. The biggest projects—from already established producing fields in the Middle East—are a double big-inch line more than 1000 miles long from the Persian Gulf via N. Iraq and possibly Turkey, and a proposed 30-inch line 600–700 miles long from Marseilles to Cologne. In the U.S.A., there are over 152,000 miles of gas trunk lines, and the network of gas distribution pipelines, over 324,000 miles, continues to grow. An important development is the laying of underwater pipelines. Large-scale pipelines now carry gilsonite and coal slurry. Coal transport is far from matching the economies of the oil pipeline. Large-dia pipelines for oil or gas are economical, provided that the size of reserves discovered and the growth of consumption to volumes which permit capacity throughputs are assured. R. T.

645. Designing the gilsonite pipeline. R. K. Bond. *Chem. Engng*, Oct. 1957, **64** (10), 249–54.—An account of the preliminary experimental work and of the performance of the finished pipeline is given. The 6-inch pipeline transports 700 tons/day of a gilsonite–water slurry over 72 miles of mountainous country, from a pumping station near the gilsonite mines to the refinery where the hydrocarbon is processed. Such design factors as pressure drop variation with particle size and liq velocity are discussed. P. J. O.

646. Hydraulics for pipeliners. C. B. Lester. *Pipe Line News*, Oct. 1957, **29** (10), 42–6.—The hydraulics of a pipeline carrying hot oil are given with special reference to the economy problems introduced by heat loss variation with buried depth of the pipe. The theory of heat loss from a hot oil pipe is given, and reference to the " arched gradient " and other peculiarities connected with this type of pipeline is made. D. K. R.

647. Recent developments in gas measurement. J. L. Griffin. *Pipe Line News*, Oct. 1957, **29** (10), 50–2.—Information is given about modern methods of measuring the flow and heating value of gas. Mention is made of various refinements to the orifice plate, and also devices for testing that the composition and heating values of the gas are in accordance with the requirements of various state boards. Lines of research being pursued are indicated. D. K. R.

648. Old pipeline converted. H. Slief. *Oil Gas J.*, 14.10.57, **55** (41), 219.—Continental Pipe Line Co. has finished the conversion from crude to products service of 100 miles of 6-inch pipeline from Wachita Falls to Saginaw, Texas. Oily substances, paraffin rust, mill scale, and sulphide had to be removed by sodium metasilicate initially, followed by diesel oil, water, hydrochloric acid, water, and finally sodium nitrite and sodium hydroxide soln as rust inhibitor. G. A. C.

649. CATCO finds new challenge in offshore pipelines. T. L. Sigler and W. L. McNatt. *Pipe Line News*, Oct. 1957, **29** (10), 37–41.—Description of the laying of 25 miles of 12-inch pipeline in waters up to 90 ft deep is given. Special references are made to the details of the preliminary survey, the design of the pipe and coatings, and the actual construction and laying of the pipeline. D. K. R.

650. How uphill and downhill flow affect pressure drop. W. E. Brigham, E. D. Holster, and R. C. Huntington. *Oil Gas J.*, 11.11.57, **55** (45), 145.—Equipment and results are described for examination of flow patterns in horizontal inclined systems. Results confirm those found by other investigators for horizontal flow, but in the inclined system stratified flow was absent. O. Baker of Magnolia Petroleum Co. follows the article by translating experimental results into field practice, and it is shown that more precise design calculations for 2-phase pipelining are possible. G. A. C.

651. Supervisory control of gas pipe lines. F. V. Long. *Pipe Line News*, Oct. 1957, **29** (10), 65–70.—After deciding whether or not a " push-button operated " pipeline is justified on the grounds of economy and efficiency, the choice of centralized or sectionalized control must be made. The advantages of both systems are presented, together with typical control systems for the 2 methods, and lists of the required telemetered information and controlled functions. Additional functions required for gas turbine or reciprocating units are given. The author looks forward to the introduction of fully automatic pipelines, and gives a typical automatic pipeline control system. D. K. R.

652. Microwave speeds Ohio Oil operations. R. M. Slough. *Petrol. Engr*, 1957, **29** (4), D20–4.—Voice channels, control, supervisory channels, and a selective telemetering system were installed to increase the efficiency of widespread pipeline operations. Communications by microwave have been found to be little affected by weather conditions. E. A. G. H.

653. Texas Gas' microwave system designed to grow. H. S. Wilson. *Petrol. Engr*, 1957, **29** (4), D25–7.—A multi-circuit, expandable system with 22 controlling points directs the operation of a large gas transmission system. Provision is made for voice control and private lines between stations. E. A. G. H.

654. Partial loops to increase pipeline capacity. G. P. Jennings. *Petrol. Engr*, 1957, **29** (5), D26–7.—When the capacity of an existing pipeline is increased, economics or the

discharge pressure may prohibit the addition of extra power. If a complete second line is not justified, then partial loops, designed to handle the immediate forecasted load, are the solution. If necessary later, the partial loops may be extended. E. A. G. H.

655. This chart saves money on pipeline maintenance. D. M. Taylor. *Petrol. Engr*, 1957, **29** (5), D28–30.—A schematic chart, forming a record of pipeline maintenance tasks completed, is claimed to promote interdepartmental co-operation and increase the general knowledge and efficiency of personnel. E. A. G. H.

656. Pipeline bridge vibration—cause and cure. R. C. Baird. *Petrol. Engr*, 1957, **29** (5), D35–41.—Pipeline suspension bridges are subject to vibrations caused by interaction of wind flow with the pipe. The shedding of vortices causes an alternating vertical force on the pipe. When the frequency of the force is close to a natural frequency of vibration of the bridge, resonant vibrations are produced. Diagonal suspension cables have reduced the vibrations successfully. Another method consisted of fitting fins to the pipe, which made it aerodynamically stable at low cost. E. A. G. H.

657. After four years wax-coated-plastic wrapped pipe good as ever. R. Jones. *Petrol. Engr*, 1957, **29** (5), D77–81.—A microcrystalline wax coating combined with a polyvinylidene chloride plastic wrapper was selected to be applied in winter to reconditioned pipe, providing underground protection inexpensively. After 4 years the coating and wrapping appeared perfect and cathodic protection requirements were small. E. A. G. H.

658. Modernization at Wamsutter simplifies operations. H. E. Keith and J. T. Burton. *Petrol. Engr*, 1957, **29** (5), D90–2.—Automatic controls installed at a pipeline booster station situated in a region of high snowfall eliminated the need for personnel to leave the station except for occasional visual inspection of equipment. E. A. G. H.

659. How river crossings are surveyed and designed. D. Tindall. *Petrol. Engr*, 1957, **29** (6), D39–56.—Methods used in pipeline crossings of the Mississippi are discussed. The river is deep with a swift current and difficult banks, thus presenting many problems. Heavy-walled pipelines for strength and negative buoyance were coated with concrete and laid in a catenary on the river bottom. Useful graphs, tables, and examples are provided. E. A. G. H.

660. One ditch, four pipelines, five products. F. H. Love. *Petrol. Engr*, 1957, **29** (6), D62–5.—5 LPG will be pumped through 4 pipelines to underground storage cavities in a salt dome. A wide ditch was dug, and the pipes were lowered into position by tractors with extended booms. Due to the high operation pressures, welding was of a high standard and extensively X-rayed. E. A. G. H.

661. Pipeline flow of oil and gas mixtures. P. B. Baxendell. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 343–51.—The purpose of this paper is to define a procedure simplifying use of the theoretical energy equation for predicting pressure lost in 2-phase pipeline flow. An empirically derived relationship linking density, velocity, and pipe size with friction factor is presented, which is analogous with the Reynolds No. relationship for single-phase flow. This relationship is believed to hold good under turbulent flow conditions regardless of crude characteristics. With decreasing mass velocity and consequent transition from turbulent to slug or stratified forms of flow, the relationship changes form and while a definite trend still exists in the case of the La Paz conditions investigated, it is considered that this trend will vary somewhat with crude visc. Further investigation of this point is in progress. Details are given of the method of constructing the working graphs from standard p–v–t analyses. The accuracy of the method is apparently $\pm 5\%$ for operation in the turbulent zone. Though not definitely universally applicable for non-turbulent flow, it provides solutions accurate to within $\pm 10\%$ under these conditions for La Paz. (Author's abstract.)

662. Progress in pipeline transportation in the mountain states. T. A. van Griethuysen. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 67–70.—Oil discoveries in the Rocky Mountain states, with insufficient competitive transportation, brought about new and enlarged crude oil and products pipelines in Colorado, Montana, Utah, and Wyoming. Because of increased pipelines, crude and products from this area are moving farther afield into new areas. (Author's abstract.)

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

663. Maintenance in an oil refinery. A. E. Newton. *Petrol. Engr*, 1957, **29** (5), C11–15.—Maintenance of a medium-sized refinery requires an efficient system allocating work requests to their proper priority. A master tool guide, which lists the tools needed for any particular job, speeds completion times. E. A. G. H.

664. Maintenance cost controls. E. C. Newton. *Petrol. Engr*, 1957, **29** (6), C26–31.—A system for manning refinery jobs most adequately and economically is described. Work methods and the standard completion times for specific jobs were established. Large jobs are divided into smaller parts, and the extent of the whole job estimated to determine the work programme. The complete co-operation of all personnel is required for the system to be successful. E. A. G. H.

665. Selecting equipment. C. J. Boner. *Petrol. Engr*, 1957, **29** (5), C33–48.—Selection of equipment is described in detail for refinery compounding plants, which combine and package lubricants. Lub greases require considerably more processing than do the fluids, so that greases need more equipment and labour per unit of product; however, the grease output of a refinery is normally much less than output of lub oils. E. A. G. H.

666. Improve your compressed air supply. R. A. Schaefer. *Petrol. Engr*, 1957, **29** (5), D82a–86.—Intake air filters maintain compressor capacity and after-cooling removes most of the moisture in the intake air. Simple mechanical controls and protective devices which increase efficiency are described. E. A. G. H.

667. Improved materials needed. E. A. Sticha. *Petrol. Engr*, 1957, **29** (5), C50–4.—Materials now in common use for large-scale refinery operations at high temp are outlined. Embrittlement of Bessemer steel when strained at 400°–500° F, formation of graphite in steels, and other service problems are described in illustration of the need for improved materials. E. A. G. H.

668. Models very efficient as design tools. B. L. Paton. *Petrol. Engr*, 1957, **29** (4), C50–6.—Scale models are being used in the design of new plants, making possible quicker reviews of a job with less misinterpretation. E. A. G. H.

669. Methods for fabrication and inspection of alloy steel piping. W. W. Offner. *Petrol. Engr*, 1957, **29** (4), C41–4.—American welding procedure and requirements are described. In radiographing welds the isotope Cæsium 137, which has a 33-year half life period, is now replacing Cobalt 60, used currently only for very heavy steel sections. E. A. G. H.

670. Sprayed-on foam slices insulation cost. C. H. Chilton. *Chem. Engng*, 1957, **64** (10), 158–62.—A method of spraying on polyurethane foam for vessel insulation has been developed. Thicknesses from ¼ to 2 inches are possible. The foam has a thermal conductivity of *ca* 0·2 B.t.u/(hr). (sq. ft.) (°F)(in), and will withstand temp up to 212° F in continuous use. Great savings in time of application are claimed for the method. P. J. O.

671. Activity of the refining industry in Poland in 1956. L. Zurkowski. *Nafta (Krakow)*, 1957, **13**, 123–7.—In spite of the fact that 1956 was started with no more than 40 days' reserve in the 5 refineries, no improvements could be reported by Dec. Only 88% of the crude expected arrived, and of this 17% rather late. In 1957 regrettably reserves are still low, but plan for refining in 1956 was exceeded in that year. Trends and figures are reviewed. New cresol refining unit went on stream in 1956, but the total solvent refined is only slightly higher than in 1955. Nearly ¾ of the dist was done by means of towers, and products were refined to a greater degree of fineness, but the value of products per ton refined fell slightly due to the fact that crude was of lower quality. Several products were introduced for the first time. Social aspects of work have improved, new improvement and good planning have brought down production costs. Summary of investment programme mentions cresol refining unit 21,000 tons p.a., asphalt blowing units 62,000 tons p.a. total capacity, acid refining unit 36,000 tons p.a. railway sidings, storage tanks, and grease factory. For 1957 plans include completion of furfural refining unit (36,000 tons p.a.), expansion of acid refining units, asphalt blowing equipment, and new power stations. In the following 4 years start will be made on the sixth refinery, which will double Poland's throughput. Consumption for 1960 is expected to reach 3 million tons. The new refinery's capacity is intended to be 1 million tons p.a., although one twice as big would not cost twice as much. M. S.

672. Automotive fuel pumps—their performance. R. A. Randall. *Petrol. Engr*, 1957, **29** (6), C24–6.—Studies were made of diaphragm-type fuel pump performance using a bench system simulating a vehicle fuel system. It was shown that the pump cavity pressure reached a minimum before the diaphragm reached the bottom of the stroke. Vapour-handling capacity was increased by running the pump at higher speed. E. A. G. H.

673. Symposium on heat transfer by flame in boilers and furnaces:

Flames and combustion: fundamental and technical aspects of recent research. J. E. de Graaf. *Ingenieur, 's Grav.*, 19.7.57, **69** (29), W85–96.—Recent results concerning gas and oil flames of the International Foundation for Flame Research are reviewed. Results of the study of pulverized coal flames are mentioned provisionally. Special consideration is given to the aerodynamic aspect of flames (mixing and flow patterns), the chemical aspect (soot formation and combustion), and the heat transfer (convection and radiation). 18 figs.

Practical heat-technological research on industrial furnaces. J. M. van Langen. *Ingenieur, 's Grav.*, 16.8.57, **69** (33), W109–4.—A description is given of the application of the results of flame research in an experimental study of the phenomena of heat transfer and gasflow in the Siemens–Martin furnace. The experiments were carried out in 4 stages: measurements in the S–M furnace itself, in the experimental furnace, and in models of the S–M and the experimental furnaces respectively. The aim was to establish laws, scale-up factors, and criteria of similarity so that the behaviour of the S–M furnace could be explained and predicted by means of measurements in the model. 7 figs, 6 refs.

The application of experimental methods developed in the Flame Research Organization. E. H. Hubbard. *Ingenieur, 's Grav.*, 13.9.57, **69** (37), W121–0.—Certain techniques and instruments used by the Foundation, such as suction pyrometers, pitot tubes, and gas sampling methods, are described. Suggestions are made as to how they can be easily used or adapted to industrial conditions. 17 figs, 14 refs.

Practical problems regarding steam and central heating boilers. A. Adam. *Ingenieur, 's Grav.*, 27.9.57, **69** (39), W133–6.—Conversion of solid fuel boilers to oil firing presents a number of problems concerning flame stabilization, complete combustion, heat transfer, and local overheating. These problems are briefly discussed, and it is emphasized that in addition to the available experience a more systematic research is required. 4 figs, 6 refs.

Some aspects of the heat technology of glass melting furnaces. F. W. Klarenbeek. *Ingenieur, 's Grav.*, 27.9.57, **69** (39), W137–0.—A brief description is given of the process and commonly used furnaces. Oil firing presents some special difficulties, as ash content and unatomized oil may contaminate the melt. Air atomization gives better dispersion than mechanical devices. The influence of air/oil ratio on fuel consumption and heat transfer is discussed. 4 figs.

Fundamental considerations regarding the shape of gas and oil burners. G. W. van Stein Callenfels. *Ingenieur, 's Grav.*, 25.10.57, **69** (43), W143–7.—After dealing with the requirements for industrial burners, a description is given of several gas burners classified according to the position of the mixing zone. The classification of oil burners is based on the quantity and pressure of atomizing air. Turbulent-jet type burners are dealt with more extensively, as they have been the subject of flame radiation research. The importance of the momentum of the flame is stressed, and consequences as to burner design are illustrated. 12 figs, 4 refs. G. F. T. C.

674. A refinery view of to-morrow's fuels. S. P. Blumberg. *Petrol. Engr*, 1957, **29** (6), C6–11.—Current trends indicate that high-performance cars will require a premium motor fuel of approximately 110 Research O.N. in 1960. The economics of a small, efficient refinery constructed primarily for producing higher octane-quality gasolines, are discussed. Marketing 3 grades of motor fuel instead of 2 is postulated to require little additional investment. E. A. G. H.

675. Regeneration of spent reagents. V. A. Kalichevsky. *Petrol. Engr*, 1957, **29** (6), C19–23.—Variable problems connected with the regeneration of spent reagents and the disposal of waste are discussed. The narrowing margin of profit from refinery operations has resulted in the max use being obtained from raw materials. E. A. G. H.

676. Developing engineers in refinery technology. D. S. Simmons. *Petrol. Engr*, 1957, **29** (6), C31–2.—The training of refinery personnel to build, operate, and maintain modern units is accomplished by an intensive short course which is outlined. E. A. G. H.

DISTILLATION

677. Modern fractional distillation processes. B. Pollard. *Chem. Age*, 19.10.57, 644.—A short introduction to dist theory. The McCabe–Thiele and other methods of calculating the number of theoretical plates required for a given separation of binary and multi-component mixtures are mentioned. Economics and operating factors effecting the use of the more recent types of column packing are considered. R. T. T. B.

ABSORPTION AND ADSORPTION

678. Gas adsorption on a copper–magnesia catalsyt. C. Potter and M. V. Sussman. *Industr. Engng Chem.*, 1957, **49** (10), 1763–8.—As the activity and adsorption power of many heterogeneous cat are closely related, and as the surface area is often an unreliable index to cat activity, it is suggested that the extent of hydrogen adsorption by a cat may be a more sensitive measure of its activity. Work done on a copper–magnesia cat is described. Hydrocarbon adsorption does not change appreciably from the active to the oxygen-poisoned cat, but hydrogen adsorption is sensitive to poisoning. D. K. R.

CRACKING

679. Regenerative platinum catalyst reforming. H. C. Nix. *Petrol. Engr*, 1957, **29** (6), C13–16.—Reforming of naphtha with a platinum cat is described. Regeneration of the cat allows low-pressure operations which result in higher gasoline yields. The cat deactivation is more rapid than in high-pressure reformers; however, lasting activity maintenance and strength of the cat make frequent regenerations possible to maintain high activities and yields. E. A. G. H.

680. Acid cleaning a catalytic reforming unit. D. M. O'Neill. *Petrol. Engr*, 1957, **29** (4), C10–12.—Scale formations of FeS in a cat reformer were removed by acid cleaning. Stringent precautions were taken due to the evolution of large quantities of H_2S which was burnt in a furnace. E. A. G. H.

681. Fluid catalyst design data. Pt 5. Calculate fluidization rates. F. A. Zenz. *Petrol. Refin.*, 1957, **36** (8), 147–55.—A review of the effects of variables which lead to the so-called "particulate" and "aggregative" fluidization characteristics is presented. A generalized chart for computing incipient fluidization rates and the velocity–bed density relationship for the particulate mode is given. The author suggests a mechanism of fluidization which might enable, at least qualitatively, a more realistic description of the forces within the bed. The practical value of such studies lies in the development of means for reducing the contact inefficiencies inherent in aggregative fluidization. J. R. T.

HYDROGENATION

682. Making butadiene. 1. J. C. Reidel. *Oil Gas J.*, 11.11.57, **55** (45), 166.—This is the first of a series of 5 articles, and reviews progress in the field since the U.S. Government sold the plants to promote industry, since which capacity has increased to 1,000,000 tons p.a. A table shows companies producing butadiene, location, comparative capacities, feedstock, and processes. G. A. C.

POLYMERIZATION

683. Gasoline synthesis fails. Anon. *Chem. Engng News*, 30.9.57, 23.—Amoco's Brownsville, Texas, plant to convert natural gas to gasoline and chemicals will be closed down. The plant has had a number of owners, and heavy capital investment costs would have to be increased if the plant were to become economic. R. T. T. B.

ALKYLATION

684. Propane chiller cuts acid losses. D. H. Stormont. *Oil Gas J.*, 11.11.57, **55** (45), 172.—A refrigeration unit installed in the acid recovery system of an H.F. alkylation plant belonging to General Petroleum Corpn's Torrance, California, refinery resulted in lower acid losses, giving a payout in *ca* 2½ years. G. A. C.

CHEMICAL AND PHYSICAL REFINING

685. Bench scale liquid extraction techniques. E. G. Scheibel. *Industr. Engng Chem.*, 1957, **49** (10), 1679–84.—Stagewise techniques for getting basic liq extraction data are described, together with an apparatus for obtaining multi-stage data for fractional liq extraction with reflux, using a minimum number of operations. D. K. R.

686. Bench scale continuous distillation techniques. F. A. Biribauer *et al. Industr. Engng Chem.*, 1957, **49** (10), 1673–8.—Information on methods of constructing and operating bench scale continuous units to obtain pilot plant data is given. Typical studies are quoted to show the effectiveness of the methods described. D. K. R.

687. Thermodynamics of solutions. H. W. Prengle, Jr., and G. F. Palm. *Industr. Engng Chem.*, 1957, **49** (10), 1769–74.—Details of the theory and apparatus for determining the vapour–liq equilibrium for binary systems by the total pressure method are given. The method allows the equilibrium to be calculated from a knowledge of the bubble point temp and pressures of the mixture, without knowledge of the composition of the vapour, thus eliminating lengthy analytical processes. Data obtained for the 2 : 2 : 4-trimethylpentane–toluene system by this method is compared with previously published data obtained with a conventional equilibrium still. D. K. R.

SPECIAL PROCESSES

688. Production of synthesis gas by restricted combustion of hydrocarbons. M. J. Brocart. *Bull. Ass. franç. Tech. Pétrole*, 1957, 367–84.—Description of Texaco process using O_2 and based on overall reaction $CH_4 + \frac{1}{2}O_2 \longrightarrow CO + H_2$, combustion is under pressure (15–70 atm) and in absence of cat. Thermal efficiency is 82%. Thermodynamic aspects and plant requirements are discussed. Gas produced may (*e.g.* for NH_3 synthesis) need to be freed from CO, which can be done by reaction $CO + H_2O = CO_2 + H_2$ using Fe_2O_3 cat, steam required is provided when synthesis gas ex reactors is given H_2O quench to reduce temp to 200° C. For NH_3 manufacture N_2 can be obtained at same time as the O_2 for combustion. Process can be adapted to use fuel oil and coal tar as raw materials; operating conditions and yields for which are given. V. B.

689. Desulphurization of petroleum coke by gas. F. Sef. *Nafta* (*Yugoslavia*), 1957, **8** (9), 283–93.—From an introductory study of the literature the author concludes that the desulphurization of petroleum coke is best with gases such as hydrogen and olefins, or gases capable of forming hydrogen in

contact with coke. Published data on optimum conditions for such processes are limited. Optimum temp are quoted which range from 600° to 900° C, but introduction of desulphurizing gases into the process at temp lower than that at which the reaction takes place appears to give better yields. Published data also suggest that prolonged reaction times, pressure, and finely ground coke particles favour the desulphurization process. However, for different coke samples, at identical operating conditions, different results are being reported. The author has investigated the effect of some process variables on the desulphurization with hydrogen of a petroleum coke prepared from the residue of the domestic Klostar crude oil. The investigated coke sample was ground to particles from 0·053 to 0·211 mm, and contained 1·98% sulphur and 6·3% volatile matter by wt. At atm pressure, at a space velocity of $2CH_2$/1g of coke/hr, and in a temp range of 500°–900° C, the sulphur of the sample was removed. The rate of desulphurization was highest between 600° and 700° C. Addition of hydrogen during the calcination favours the removal of sulphur more effectively than by passing hydrogen through the coke at given reaction temp, after the coke was calcined to this temp in a stream of inert gas. In this way desulphurization of calcined coke at 850° C after 360 minutes removed only 16·3% of sulphur, while during the same space velocity and pressure, at 450°–800° C, the amount of sulphur removed was 67·5%. It was established that the volatile matter content of coke has an essential effect on the amount of sulphur removed. By a stepwise heating of 2 coke samples containing 0·8 and 17·1% volatile matter in a stream of hydrogen between 450° and 800° C for 160 minutes and identical other conditions, the amount of sulphur removed was 15·5 and 62·0% respectively. The rate of desulphurization with hydrogen increases rapidly with increasing volatile matter contents from 0 to 6%, but a further increase of the latter has only little effect.

(Author's abstract.)

METERING AND CONTROL

690. Meter factor control charts solve measurement problems. L. M. Davis. *Petrol. Engr*, 1957, **29** (5), D22–5.—Inconsistency of metering due to improper functioning of personnel or equipment was determined by the use of control charts at each metering location. Any deviations from average show on the charts, and the meter can be inspected for faults. Personnel efficiency was demonstrated in the periods when consistent results were obtained. E. A. G. H.

691. Custody transfer with positive displacement meters. J. F. Morris. *Petrol. Engr*, 1957, **29** (5), D68–76.—Oil is transferred between 2 companies completely automatically by the use of a positive displacement meter. The equipment is simple, inexpensive, and easy to maintain. E. A. G. H.

692. How to programme two-stage compressor data for digital computers. K. A. Kissling. *Petrol. Engr*, 1957, **29** (6), D20–6.—A method of using a high-speed automatic calculating machine for the calculation of performance data for 2-stage gas compression is presented and data are given in graphical form. E. A. G. H.

PRODUCTS

CHEMISTRY AND PHYSICS

693. The relation between Redwood No. 1 seconds and kinematic viscosities. M. Kinoshita. *J. Inst. Petrol.*, 1957, **43** (401), 152–60.—27 oil samples, covering a range of 2–200 cS at temp between 30° and 100° C were used to evaluate the relation between kinematic visc and Redwood No. 1 sec. Measurements were made in 4 lab on conventional Redwood No. 1 viscometers and results analysed statistically and compared with kinematic visc measured by the author at the same temp. An equation is derived which can be used to convert cS to Redwood No. 1 sec for visc of greater than 3 cS and temp 20°–100° C. Results of previous experimental work are given and compared with those found in the present study. A critical study is made of the Ubbelohde conversion table, and a new one is given. 13 refs. C. B.

694. The relation between Saybolt universal viscosities and kinematic viscosities. M. Kinoshita. *J. Inst. Petrol.*, 1957, **43** (401), 161–4.—Data found during experiments to determine the correction factors of conventional Saybolt viscometers are used to derive a relation between Saybolt universal and kinematic visc. Results are compared with those of previous workers and with the ASTM conversion table, and an expression for the conversion of kinematic visc to Saybolt universal sec over the temp range 70°–300° F and for visc greater than 2 cS is given. 8 refs. C. B.

695. Predicting chemical reactions by thermodynamics. R. Ciola. *Industr. Engng Chem.*, 1957, **49** (10), 1789–92.—A simple method of forecasting chemical behaviour, especially at high temp, from the logarithms of the equilibrium constant of formation of hydrocarbon and non-hydrocarbon groups is given. The method requires only the equilibrium constants for the groups changed in the reaction, and values of (log K_{fg}) are tabulated for many common hydrocarbon and non-hydrocarbon groups. D. K. R.

696. Generalized heat capacities. W. R. Gambill. *Chem. Engng*, Oct. 1957, **64** (10), 283–8.—Generalized correlations are presented for the rapid estimation of heat capacities of natural gas, petroleum, and hydrocarbon vapours. The effect of pressure on C_p is discussed, and methods of determining it presented. Finally, methods of finding the ratio of or difference between C_p and C_v are given. This is the last of a series of 6 articles. P. J. O.

697. Critical temperatures of pure hydrocarbons. A. W. Francis. *Industr. Engng Chem.*, 1957, **49** (10), 1787–8.—The equation $t_c - t_b = 180 - \frac{214}{n^{1.5}}$ is given, relating the b.p. and critical temp of normal paraffins, where n is the number of carbon atoms. This gives a value of within 1° C of observed values for C_3 to C_{12}, though differing from other estimates quoted for high values of n. For branched paraffins and olefins with the same carbon content the values of t_c and t_b are about the same as for normal paraffins. D. K. R.

698. Pressure–temperature–liquid density relations of pure hydrocarbons. A. W. Francis. *Industr. Engng Chem.*, 1957, **49** (10), 1779–86.—Density data for co-existing liq and vapour phases of hydrocarbons are usually plotted as oblique "parabolas" with "rectilinear diameters." As this relation is not strictly accurate, quadratic equations of the form $Ds = A - Bt - \frac{C}{E - t}$ are given for the "diameters." These hold, from the b.p. almost to the critical temp. Values of A, B, C, and E are given for 44 pure hydrocarbons. D. K. R.

699. Thermodynamic properties of pure and mixed hydrocarbons. Pt II. M. Hobson and J. H. Weber. *Petrol. Process.*, Sept. 1957, **12** (9), 153–7.—An article on latent heats

of hydrocarbon mixtures is presented. Several methods are discussed with a note on comparisons between methods.
P. J. O.

700. The measurement of the surface tension and interfacial tension of insulating oils. L. Massey, N. N. Murty, and C. N. Thompson. *J. Inst. Petrol.*, 1957, **43** (406), 282–7.—In the course of a programme of co-operative testing under the auspices of Panel E/Ac of the Electrical Research Association (ERA) it became apparent that the IP 90/55T method for the surface and interfacial tension of insulating oils required modification. The paper describes work done on the measurement of interfacial tension of new and used oils. The interfacial tension is found to vary with the age of the interface and adoption of the ASTM One Minute value is suggested. Modifications to the present IP method are described, and it is stressed that the current requirements for cleaning the apparatus are not sufficiently rigorous. Finally, the suggested method is presented in full. 4 refs. C. B.

ANALYSIS AND TESTING

701. The separation of mixtures of biphenyl, *cyclo*hexylbenzene, and bi*cyclo*hexyl by vapour phase chromatography. W. J. Hendriks, R. M. Soemantri, and H. I. Waterman. *J. Inst. Petrol*, 1957, **43** (406), 288–91.—Columns containing (1) dioctyl phthalate on ground firebrick and (2) silicon 702 on Celite with N_2 as the carrier gas were used to separate quantitatively mixtures of biphenyl, *cyclo*hexylbenzene, and bi*cyclo*hexyl. The method of analysis, the calibration of the apparatus, and the extension of the method to cover 6 component mixtures are described. The relationship between thermal conductivity and correction factor is discussed. 3 refs. C. B.

702. Analytical method to determine total sulphur rapidly in volatile hydrocarbons. P. J. Sullivan. *Petrol. Engr*, 1957, **29** (4), C19.—Due to the length of time required by normal methods a new test for determining total sulphur quickly was devised. The sample is placed in a high temp furnace and the gases are absorbed in HCl. E. A. G. H.

703. Scuffing tests for gear oils. Anon. *J. Inst. Petrol.*, 1957, **43** (404), 230–2.—Description of the tentative Standard Method IP 166/58T which covers the operation of the IAE 3¼-inch Centres gear machine as a test rig to evaluate the scuffing of gear oils at speeds of 2000, 4000, and 6000 rev/min. 4 refs. C. B.

704. Measuring the precision of test methods. E. A. Field. *J. Inst. Petrol.*, 1957, **43** (404), 233–4.—The author describes the evaluation of the repeatability and reproducibility of new test methods. C. B.

705. Petter engine tests of diesel lubricating oils. R. Tourret and R. W. Bale. *J. Inst. Petrol.*, 1957, **43** (406), 273–81.—The Caterpillar method of rating engine oils is time-consuming and expensive. Accordingly, the Admiralty Oil Laboratory (AOL) has carried out a series of test runs using various oils in a series of Petter AV.1 engines, and the AT/4 test method, in an attempt to correlate oil performance in the Petter AV.1 and Caterpillar engines. The engines, oils, fuels, and tests carried out are described in detail, and results obtained in both engines are compared. It is concluded that where a wide range of base lubricants and additives are being tested, there is an appreciable difference between performance in the Caterpillar and Petter engines and no correlation between them is possible. 3 refs. C. B.

706. Report of IP Carbon Residue Panel. Anon. *J. Inst. Petrol.*, 1957, **43** (406), 292–6.—An account of the co-operative testing programme initiated by the Carbon Residue Panel to determine whether the Conradson method should be deleted from Standard Methods, and to check the correlation between Conradson and Ramsbottom results. Detailed results of the tests carried out are given. C. B.

707. Some applications of radioactivity in the petroleum industry. J. L. Putman. *J. Inst. Petrol.*, 1957, **43** (404), 215–26.—A brief consideration of the basic properties of radioactive materials and methods for their detection is followed by a description of their application in the petroleum industry. An account is given of the use of radioactive sources in well and borehole logging and of the use of radioactive tracers in oil wells and in refinery control. Mention is made of the use of radioactive materials in the analysis of products, in pipeline operations to locate leaks, interfaces, and lost pigs or go-devils. The irradiation of engine components enables the amount of wear occurring to be checked from the resultant radioactivity of the lub oil. Wear of machine tools is studied in a similar fashion. Finally, the reactions occurring in hydrocarbons after high levels of irradiation are briefly discussed. 48 refs and 5 pages of discussion. C. B.

708. Influence of temperature on stability of fire extinguishing foams. R. Juchniewicz. *Nafta* (*Krakow*), 1957, **13**, 138–41.—The object of this work has been to explain the behaviour of some foams when met by hot gases. It has been found possible to build a lab unit which duplicated and allowed the measurement of the course of events at critical conditions. A number of foams have so been examined, and results are given in the form of graphs. M. S.

CRUDE OIL

709. Automatic custody transfer of crude oil. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 15–32.—**General considerations.** H. C. Packard.—LACT may be defined as equipment and procedures whereby the measuring of quantity and quality and the running of crude oil from the producers' leases to the connected pipeline is accomplished on a completely automatic and therefore unattended basis, and all in accordance with any predetermined schedules required and with applicable regulations. Industry-wide exchange of information, ideas, and design and test data has been accomplished chiefly through the LACT special project function of the API Committee on Crude Oil Measurements. Actual design, installation, and testing of specific equipment have been done by individual companies.

From the producer's viewpoint. H. S. Kelly.—Automatic custody transfer is attractive to the producer because it offers improvements over manual testing and gauging in stock tanks. The investment advantage which the LACT battery has for the larger vol makes it attractive for tank battery consolidations. When all factors favourable to the LACT battery, from the producers' viewpoint, are taken into consideration, it may be possible to justify the use of the LACT system on leases producing as little as 50 b.d.

From the pipeliner's viewpoint. A. H. Newberg.—Experience reported during the past 2 years in the testing of several lease automatic custody transfer systems is providing good reason for pipeliners to have renewed confidence in accepting such systems. With many systems and techniques tested under field conditions, it is now possible to obtain measurement accuracy comparable with present manual methods. Pipeline companies will undoubtedly consider LACT installations on an individual basis, critically analysing each proposal from a design and operating viewpoint. Each

system must provide ability to control lease runs where regulations require assurance that: (1) the oil is saleable before it is run, and (2) the system is " fail-safe " against mismeasurement. In the near future pipeliners should begin to study the practical and physical aspects of incorporating LACT proposals in their pipeline systems to obtain, where possible, the potentially more efficient and economical service. With LACT supplying the only true missing automation link between production and transportation, the industry's position remains progressive and favourable in the competitive future. (Authors' abstracts.)

GAS

710. U.S. plans liquefied methane shipments to U.K. Anon. *Chem. Age*, 9.11.57, 758.—2 U.S. companies propose to construct a " vacuum bottle " type tanker for methane. The construction of 60,000-ton tankers is envisaged. A cost of 80 c/10^3 ft^3 against 100 c/10^3 ft^3 for manufactured gas is considered possible. R. T. T. B.

711. Cold degasolination and dehydration of natural gas. J. Aymon and A. Narbonne. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 371–9.—Cold degasolination and dehydration of natural gas have to-day become conventional processes. Completely automatic portable units give excellent results in this field. The paper shows how these problems were solved by the " Régie Autonome des Pétroles " during the second world war, using a plant which was designed and set up specially for the purpose. Modern units still comprise the essential organs of the earlier plant, and while the output obtained was not so high as that obtained at present, the method adopted not only offered the advantage of being a pioneer process in modern technique, but at the same time enabled the delivery of large quantities of fuel which in France at that time was as scarce as it was precious. (Authors' abstract.)

712. Interchangeability with natural gas. P. Delbourg and H. Schneck. *Riv. Combust.*, 1957, **11** (7–8), 466–92.—The communication is divided into 6 chapters. (1) The principal methods, which are used in the U.S.A. to treat the problems of interchangeability with natural gas, are explained in detail. (2) The operating method, which is employed to bring the experimental study to a successful issue, is explained and the total results obtained with each of the examined gases are summed up in the tables given in the appendix. (3) 3 indexes of interchangeability have been chosen to characterize the gases of the second class. The first two are used to represent phenomena of incomplete combustion by carbon oxide production, separation, and return of flames. The third index is used independently of the other two to characterize the phenomena of appearance of yellow points in the aerated flames and of the solid carbon production. The complete study of *ca* 12 utilization devices permits the determination of the limits which are admissible for the different interchangeability indexes. The influence of the feeding pressure fluctuations of the devices has also been studied. (4) In order to increase the interchangeability possibilities of gases of the second class, the various modifications, which are to apply either to the devices for utilization or to the feeding pressure, have been reviewed and led to interesting conclusions concerning the ways to follow in the future. (5) The control burner " Gaz de France," which has been developed for the first class gases, has been modified in order to be used for the quality control of gases of the second class. A control test of this quality has been set up, as well as a method permitting the determination of the 3 interchangeability indexes for gases of the second class to be made only by means of the control burner. (6) Some practical examples of applications of the interchangeability methods have been dealt with in order to familiarize the reader with these methods, and also to show the difficulties which arise in the production of gases which can be substituted for natural gas. (Authors' abstract.)

ENGINE FUELS

713. Knock ratings now predictable. L. C. Beard. *Oil Gas J.*, 18.11.57, **55** (46), 233.—If the chemical structure of a pure hydrocarbon is known the knock rating can be estimated with reasonable accuracy. G. A. C.

714. Economics of producing high octane pool gasoline. S. W. Curry. *Petrol. Engr*, 1957, **29** (5), C6–9.—Future requirements in the U.S.A. indicate that demand will steadily increase octane ratings of all grades of gasoline. Economic evaluations show that the least costly route to high octane ratings over 100 appear to be alkylation and isomerization, followed by extraction of cat reformates. E. A. G. H.

GAS OIL AND FUEL OIL

715. Oil firing. G. J. Gollin. *Inst. Petrol. Rev.*, 1957, **11** (130), 263.—This is an extensive review of the properties and use of liq fuels. Oil burning systems, functions of the burners, blast, pressure type, and hybrid (pressure jet plus steam jet) burners, automatic controls, oil-fired installations in power stations, shell type boilers, open hearth furnaces, brick kilns, and high intensity combustion and gasification are authoritatively dealt with. G. A. C.

716. Pulverized coke fires clean in first refinery use. J. Brendler. *Oil Gas J.*, 4.11.57, **55** (44), 142.—Cities Service Oil Co. is burning 160 tons/day pulverized petroleum coke to raise steam at its East Chicago refinery. It was found necessary to pulverize finely and maintain high firebox temp, as well as modify the burners and firebox. Stacks were as clean as those obtained with gas-fired boilers. G. A. C.

LUBRICANTS

717. Separation of polymers from lubricating oils. A. Groszek. *J. Inst. Petrol.*, 1957, **43** (402), 184–5.—Silica gel adsorption chromatography is used to separate polymers having a mol. wt. greater than 10,000 from lub oils. Results are given for the separation of polymethacrylates from mineral oils. 4 refs. C. B.

718. Copper–lead bearing inhibition in diesel service. J. R. Thomas *et al.* *Industr. Engng Chem.*, 1957, **49** (10), 1703–8.—As the result of much study into the corrosive mechanisms found in engines and the ways in which these can be counteracted, a class of oil additives which inhibit corrosion with both copper–lead and silver bearings was developed. Details of the corrosion mechanisms, mechanisms of corrosion inhibition, and experimental test procedures are given. D. K. R.

719. Oil cooling and oil coolers. 4. Aircraft oil coolers. G. A. Montgomerie. *Sci. Lubric.*, 1957, **9** (6), 14–19.—Basic design data for air-cooled oil coolers for aircraft are presented, mechanical conditions encountered are discussed, essential performance conditions enumerated, and difficulties arising from low temp conditions are noted. Special conditions obtaining when fuel is used as cooling medium are briefly considered. J. G. H.

720. Power unit lubrication. E. D. Shannon. *Pipe Line News*, Oct. 1957, **29** (10), 28–34.—As a result of the increased use of gas engines in the last few years, a lubrication test programme was instigated by the Humble Oil and Refining Co. Details of the tests performed on 2- and 4-cycle gas engines, and the results and conclusions drawn are given. A list of recommendations of the type of lubricant best suited for the various components of the engines and miscellaneous gas plant equipment is presented. Also for the types of lubrication to be used with electric motors and reciprocating steam equipment. D. K. R.

721. Lubrication in iron and steel works. *J. Iron Steel Inst.*, 1957, **187** (2), 128–43. Discussion on paper by H. Jones and G. D. Jordan. *J. Iron Steel Inst.*, 1957, **185** (3), 389–408. (cf. Abs. **1183**, 1957).—A crit informative discussion indicates the necessity for commonly agreed units, and recognition of the different backgrounds of different nations. Lubrication engineers are necessary, but their status and duties require definition. Colour coding schemes present difficulties, owing to the strained supply of colours for identifying steam, gas, etc. Before condemnation they merit further trial. A card system for covering plant lubrication is described. German institutions have improved colour coding by using different colours and shapes—as illustrated—for oils and greases. German mines—following the reduction trend—specify 9 oils and 3 greases. Collaboration between plant builders, lubrication engineers, and lub suppliers is essential. Acidity and sap. val. tests for turbine oil deterioration—found unsatisfactory in Germany—are replaced by the centrifugation test described. A new steam test for turbine lub emulsification is discussed (see *BrennstChemie*, 1956, **37**, pp. 336 *et seq.*). Rolling-mill and gear oils should have low d for better H_2O separation; visc should be specified by the maker. Obsolete and modern designs for bearings are criticized relative to lubrication. The authors support an adverse criticism of B.S. 210. French oil classifications are presented. Relevant factors in gravity-type and pressure-controlled oil systems, and filter positioning are debated. Other subjects debated are dry MoS_2 lub, flexibles, and crane-wheel and crane-rail wear. Supporting charts and tables are presented. R. T.

722. Conference on Lubrication and Wear. Pt II. R. Tourret. *Petrol. Times*, 8.11.57, **61** (1572), 1011.—Titles and summaries are given of a further 41 of the 104 papers presented at the Conference of Institution of Mechanical Engineers, Oct. 1957. G. A. C.

723. Metal terephthalmates. B. W. Hotten. *Industr. Engng Chem.*, 1957, **49** (10), 1691–4.—This new class of oil-gelling agents gives better combinations of many important gel properties than do the conventional soaps of animal and vegetable fatty acids, especially when dealing with mineral oils. Descriptions of the experimental procedures for synthesizing various terephthalmates are given, together with descriptions and tables of their physical, crystallographic, and gelling properties. D. K. R.

724. Lubricants for compressors. J. H. Caldwell. *Petrol. Engr*, 1957, **29** (3), D40–54.—The selection and evaluation of performance of compressor lubricants is discussed. In 2-cycle engines carbon deposits indicate a poor performance. Care should be taken to employ the correct lubricator oil rate, for which an empirical formula is given, otherwise carbon deposits increase. Bearing inspection discovers oxidn troubles. E. A. G. H.

725. A new high performance grease mixer. O. L. Yarham and P. R. Sigler. *Petrol. Engr*, 1957, **29** (4), C46–50.—The mixer was designed to combine high-speed intensive mixing with the conventional wall-scraping type of agitator. Uniformity of mixing and temp control with widely varying visc have been accomplished. E. A. G. H.

726. The plunger rheometer—law of flow for a Newtonian liquid. G. S. Smith. *J. Inst. Petrol.*, 1957, **43** (404), 227–30.—After a brief consideration of the results of previous workers, the author derives an expression for the law of flow of a Newtonian liq in a cylindrical plunger rheometer. 5 refs. C. B.

BITUMEN, ASPHALT, AND TAR

727. The properties of asphaltic bitumen in relation to its use in road construction. A. R. Lee and J. H. Nicholas. *J. Inst. Petrol.*, 1957, **43** (405), 235–46.—Rheological properties of the bituminous binders are considered, in particular the tendency to deformation and the effect of temp and traffic conditions on this tendency. The relationship between the " stiffness " properties of the binder and low temp fracture is discussed. The effect of the addition of polymers to the bitumen is described. Adhesive properties of the binder and the problems of stripping of the binder by water are discussed and the use of surface active agents to combat this stripping is described. The durability of bituminous carpets is discussed at length with particular reference to optimum binder content and to oxidn resistance of the bitumen. 21 refs. C. B.

728. Hot asphalt construction. P. C. Leaver. *J. Inst. Petrol.*, 1957, **43** (405), 247–71.—A brief description of the types of bituminous material available for road construction work is followed by a discussion of the specifications, British Standard and Air Ministry, which cover hot asphalt. Asphalt manufacturing plant, which includes mechanical feeding devices, cold end equipment heaters for the materials and for drying aggregates, screens and hot storage bins, proportioning and measuring equipment, and mixing and transportation equipment is described at length. The techniques of laying hot asphalt are described with special reference to rolling, raking, evenness of surfaces, precoated chippings, and joints. The organization involved in the carrying out of large-scale contracts is outlined. Brief mention is made of lab tests for the maintenance of quality control, and finally some examples of hot asphalt construction work are given. 12 refs and 6 pages of discussion. C. B.

729. Asphalt-prime building material for new national highway system. E. J. Barth. *Petrol. Engr*, 1957, **29** (4), C13–18.—The literature on asphalt as a building material is surveyed. Reasons for asphalt failure and desirable properties of asphalts are given. 30 refs. E. A. G. H.

SPECIAL HYDROCARBON PRODUCTS

730. Process improvements enhance outlook for petrochemical acetylene. C. H. Chilton. *Chem. Engng*, Oct. 1957, **64** (10), 144–5.—A new Belgian process for the production of acetylene by partial oxidn of hydrocarbons is described. The process is designed to handle a wide range of feeds; it uses a new water-cooled metal burner to eliminate carbon formation in the oxidn stage, and liquid ammonia as the final absorbent. P. J. O.

731. Three-in-one process gets butadiene and avgas. T. P. Forbath. *Chem. Engng*, Oct. 1957, **64** (10), 224–7.—The flowsheet is presented of a new plant for production of butadiene and aviation gasoline from butane. The plant combines the Houdry dehydrogenation process, operating at

3·5 p.s.i.a. and 1150° F, butadiene recovery by furfural extractive dist, and sulphuric acid alkylation. *iso*Butylene and isoprene can also be made, with minor changes, and considerable flexibility is claimed for the system. P. J. O.

DERIVED CHEMICAL PRODUCTS

732. Hydrocarbon sulphonation goes continuous. C. H. Chilton. *Chem. Engng*, Oct. 1957, **64** (10), 154–5.—3 new plants for continuous sulphonation are described. They make lub oil additives and detergents, and are intended to supersede conventional batch sulphonation kettles. P. J. O.

733. A cheap way to remove S from H_2S. G. M. Franklin, L. V. Kunkel, and M. Webb. *Oil Gas J.*, 4.11.57, **55** (44), 144.—A new economical method based on Claus process is used by Pan American Petroleum Corpn in operating a small plant for recovery of sulphur. Process is economic for capacities of less than 12 tons/day, and may be justified for up to 50 tons/day. G. A. C.

734. Chemicals from petroleum. Chapter XV. V. A. Kalichevsky. *Petrol. Engr*, 1957, **29** (4), C26–35.—The growth of the petroleum chemical industry and various unit processes used are outlined. Simple petroleum hydrocarbons that are easily isolated are used in chemical manufacture. The uses of petroleum products and of other cpds made from these products are mentioned. E. A. G. H.

735. Which plants make what petrochemicals? Anon. *Petrol. Process.*, Sept. 1957, **12** (9), 139–49.—An alphabetical list of 350 petroleum chemicals gives information on each, *i.e.* methods of manufacture, description, and use, and also acts as an index to the previous list of petroleum chemical manufacturers. P. J. O.

736. Petrochemical plants in the U.S. and Canada. Anon. *Petrol. Process.*, Sept. 1957, **12** (9), 121–39.—An alphabetical list of U.S. and Canadian firms interested in petroleum chemicals is given, with information on hydrocarbon raw materials used, products, output, principal personnel, and (sometimes) original plant investment for each. P. J. O.

737. Petrochemicals race ahead. H. G. McGrath. *Petrol. Process.*, Sept. 1957, **12** (9), 101–5.—A survey of the petroleum chemicals industry, covering investment, production, and growth up to 1957, and predicting future trends. P. J. O.

738. Other major petrochemicals. Various. *Petrol. Process.*, Sept. 1957, **12** (9), 108–20.—A number of reviews discuss each of the major petroleum chemicals in turn, namely, ammonia, aromatics, butadiene, carbon black, cresylics, ethylene, formaldehyde, synthetic detergents, polypropylene, polyethylene, styrene, sulphur, synthetic fibres, urethanes, and synthetic rubber. P. J. O.

739. Petrochemicals gain in 1957. R. L. Bateman. *Petrol. Process.*, Sept. 1957, **12** (9), 106–7.—The growth of the petroleum chemicals industry in 1957, slower than in previous years, is discussed and analysed. P. J. O.

740. The petroleum industry—source of chemical raw materials. W. E. Kuhn and J. W. Hutcheson. *Petrol. Engr*, 1957, **29** (6), E3–7.—The amount of chemicals derived from petroleum in the U.S.A. rose from 5% in 1940 to 25% in 1955, and is expected to increase to 50% by 1962. The type and variety of products which can be made from the raw materials by chain-like reactions is unlimited. It is not expected that the growth of the petroleum chemicals industry will affect the supply of petroleum products. E. A. G. H.

COAL, SHALE, AND PEAT

741. Ozone oxidation of phenanthrene to diphenic acid. W. F. O'Connor, W. J. Schmitt, and E. J. Moriconi. *Industr. Engng Chem.*, 1957, **49** (10), 1701–2.—Lab and pilot plant investigations of the conversion of phenanthrene to diphenic acid by ozonolysis are described. Details of the procedure, equipment, and results obtained are given. After study of variables such as cat, ozone concn, etc., yields of up to 56% were obtained. This may provide a low cost method of achieving this normally expensive conversion. D. K. R.

742. Problem of raising production of substitute raw materials replacing crude oil in Poland. S. Tertil. *Nafta (Krakow)*, 1957, **13**, 103–5.—More gasoline and cracked gases are required every year, and there is a need for substitute raw materials. Whilst hydrogenation of coal is too expensive, the same process applied to shales and brown coal will provide for some extra needs. The merits of French, Swedish, and German methods for obtaining oil from shales are reviewed and the work done at the Polish Institute for Chemical Conversion of Coal is summarized. M. S.

MISCELLANEOUS PRODUCTS

743. Commercial production of GR-S. K. G. Burridge. *Proc. Instn Rubb. Ind.*, 1957, **33** (5), 178–87.—The International Synthetic Rubber Co. is erecting a plant to produce 50,000 tons p.a. of GR-S synthetic rubber by butadiene–styrene copolymerization. GR-S covers copolymers containing butadiene–styrene 75–25%. A brief description of properties and historical background is given. Individual polymerization of the separate components is prevented by adding *tert* butyl catechol, which is removed later from butadiene by an aq NaOH wash. In the GR-S process the polymerization system is an emulsion of the monomer or monomers in an immiscible liq, H_2O. The emulsion system permits using a redox cat. Soap is added as a promoter and stabilizer. A modifier, usually a mercaptan, is important for directing the polymerization course and controlling mol. wt. All the materials for the reaction—the activator excepted—are charged via the cooler in the temp range 41°–55° F. The oxidant—conventionally an org hydroperoxide—is added to the charge stream. The activator with redox cat—an aq soln of inorg salts—is added at the entry point to the reactors. A short stop is added when approx 60% of the monomers has reacted to form polymer. Further reaction would be uneconomical and would increase the proportion of branched chains. Latex processing is described, including antioxidant and extender addn. Properties and applications of GR-S in rubber manufacture are discussed. R. T.

CORROSION

744. Corrosion effects of hydrogen sulphide and carbon dioxide in oil production. W. F. Rogers and J. A. Rowe, Jr. *Proc. Fourth World Petrol. Congr.*, 1955, **2**, 479–99.—Lab studies have been made of the predominant factors in corrosion of steel by oilfield brines containing hydrogen sulphide or carbon dioxide. Theoretical electrochemical relations at the anode and cathode have been combined to develop relations expressing the corrosion rates to be expected. These have been modified in accordance with cathode potential values determined by experiment. The resulting equations show that corrosion rates under sulphide conditions are greater than those under carbon dioxide conditions. This correlates with field experience. The experimental data show that sulphide cathodes have a lower potential than those of carbonic acid environments. As an additional important factor, sulphide cathodes are more difficult to polarize than cathodes in carbon dioxide environments. The net result of an anode of high potential and a cathode of low potential with difficult polarizable characteristics is a high corrosion rate and low pitting factor. A theory of corrosion under sulphide conditions has been developed which considers corrosion to occur in 2 stages. The first, or initial stage, is low and occurs until a sulphide cathode of low polarization characteristics develops; this results in the second, or high corrosion, stage. Field data are presented supporting this theory.
(Author's abstract.)

745. Maintaining microwave equipment under corrosive conditions. C. G. Fuller, Jr. *Petrol. Engr*, 1957, **29** (5), D61–6.—Microwave equipment controlling pipeline operations may be subjected to corrosive conditions near producing areas due to concn of H_2S in the atmosphere. Costly silver-plated components are replaced by new ones plated with rhodium or protected with special grease. Constant maintenance and inspection is needed for other equipment.
E. A. G. H.

746. An economic study of underground corrosion preventive measures. D. Glass. *Petrol. Engr*, 1957, **29** (4), D33–40.—Data indicate that for a bare trunk pipeline, corrosion preventive measures were effective and less expensive for the first 15 years' operation than reconditioning, coating, and application of cathodic protection to supplement coating. A survey is made of 28 leading pipeline companies, reporting pipe laid from 1930 to 1955, the type and cost of protection, and the effectiveness of protection. E. A. G. H.

747. Hydrogen blistering. R. T. Effinger. *Oil Gas J.*, 14.10.57, **55** (41), 222.—The nature of hydrogen attack and conditions favouring blistering in cat cracking plants are described. It can be reduced by improved feed preparation and better control of cat quality. The attack occurs where water or sulphides are present and where either low or high pH values prevail. G. A. C.

748. Cooling-system maintenance pays off. D. Haack. *Oil Gas J.*, 4.11.57, **55** (44), 163.—Pt I of a series describes various cooling systems including conventional liq cooling and vapour-phase cooling and reviews general rust and corrosion preventive maintenance and use of inhibitors. G. A. C.

749. Cooling-system costs cut by corrosion and scale prevention. W. H. Carls, Jr. *Petrol. Engr*, 1957, **29** (5), D52–6.—Treatment of cooling-water systems with water-conditioning chemicals avoids scale formation and corrosion which reduce efficiency and raise maintenance costs. Scale formation may be lessened by using softened water or surface-active agents, by avoiding constant recirculation of the water in the system with no bleed off, or by the deposition of a controlled carbonate scale. Corrosion protection is obtained by the addition of polyphosphates, sodium silicate, chromates, or an activated sodium sulphite. E. A. G. H.

750. Phenolic coating eliminates vessel corrosion. H. D. Schmidt. *Petrol. Engr*, 1957, **29** (6), C17.—Corrosion by hydrochloric acid in a vessel used for sweetening gasoline by the use of copper chloride necessitated the application of a phenolic coating with high abrasion resistance. This inexpensive coating has proved satisfactory after 2 years service. E. A. G. H.

751. Corrosion of oil-industry storage tanks. J. S. Hume. *Oil Gas J.*, 11.11.57, **55** (45), 153.—Results of a survey on tank corrosion are given by members of an API sub-committee on corrosion. Specific aspects include coatings and linings, corrosion inhibitors and neutralizers, storage tank design, and construction materials. G. A. C.

752. When is a test not a test? L. F. Bramble. *Pipe Line News*, Oct. 1957, **29** (10), 54–60.—The author questions the significance which may be placed on lab tests on a material if they are not complemented by tests performed in the environment in which the material will actually be used. The necessity for examining test results most carefully to ensure that the conclusions drawn from them are correct is stressed, with examples of possible misinterpretation. D. K. R.

753. Corrosion and cathodic protection. Pt 1. H. V. Beezley and G. R. Olson. *Petrol. Engr*, 1957, **29** (5), D31–4.—The principles and causes of corrosion of pipelines are discussed.
E. A. G. H.

754. Cathodic protection system for refinery jetties. W. Sekules. *Petrol. Engr*, 1957, **29** (5), C20–6.—Underwater steelwork of refinery jetties is protected by a cathodic system. The amount of protection current required in this Australian project is large, so that galvanic magnesium anodes were not suitable. A power-impressed system, with ground-beds of graphite anodes fed by a transformer-rectifier, keeps the steelwork at a negative potential with respect to the sea.
E. A. G. H.

755. Cathodic protection of offshore structures. A. H. Massad and B. G. Holmes. *Petrol. Engr*, 1957, **29** (5), B73–80.—Steel structures for offshore well development are protected from corrosion by 3 methods. The atmospheric zone is protected by paint and monel sheathing is used for the splash zone. Cathodic protection by magnesium-anode systems or rectifier units are used for underwater protection. Offshore gathering lines are coated with coal tar, felt, and cement and if necessary cathodic protection is added. E. A. G. H.

756. Economics and effectiveness of cathodic protection on large diameter pipelines. N. K. Senatoroff. *Petrol. Engr*, 1957, **29** (3), D26–9.—Cathodic protection applied to a 26-inch line from 2 electrical drainage stations was ineffective because the line was already extensively pitted through electrolytic corrosion. The pipe was reconditioned and a layer of protective material applied. After reconditioning, the cost of cathodic protection decreased, and the combination of the 2 types of protection proved successful. Potential line throughput has increased. E. A. G. H.

757. Corrosion measurements in a hydrogen sulphide water absorption pilot plant. B. W. Bradley and N. R. Dunne. *Proc. 36th ann. Conv., nat. Gas Ass. Amer.*, 1957, 4–9.—In evaluating gas processing facilities to sweeten an extremely

sour natural gas, Shell Oil Co. technologists estimated high pressure water absorption followed by simple low pressure flashing would be attractive. Consideration of reduced heat exchange and stripping heat requirements indicated that appreciable savings in investment and operating costs could be effected by the process. Accordingly a water absorption pilot plant was constructed and operated for a brief period to establish the absorption and desorption characteristics under the existing field conditions. Since corrosion problems were anticipated, a series of corrosion evaluation tests was conducted concurrently in the pilot plant. Carbon steel corrosion rates, although very high during the first few hours or days, were found to diminish to a tolerable level within the 19-day test. Killed carbon steel, stainless steel type 304, Inconel, and K-Monel were found resistant to sulphide stress corrosion cracking. Inconel, Monel, and 304 also showed low weight loss corrosion. Hydrogen probes indicated decreasing corrosion rates in absorber and degasifying drums during the test period. A water-dispersible, amine type inhibitor reduced carbon steel corrosion rates and indicated protection from sulphide stress corrosion cracking. These data indicate stress relieved carbon steel vessels and piping with corrosion resistant alloys for critical process parts, such as pumps, Bourdon tubes, thermometer wells, orifice plates, and relief valve springs would provide acceptable service life. The test data also indicate that carbon steel weight loss and sulphide corrosion cracking severity of the environment can be reduced by inhibition. (Authors' abstract.)

ENGINES AND AUTOMOTIVE EQUIPMENT

758. The changing character of the American automobile. V. C. Raviolo. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 200–3.—The American automobile of the near future must incorporate not only those ideas which represent real improvements but also those which can be translated into practical design without serious difficulty with regard to engineering. These changes do not necessarily express the consumer's viewpoint or demands; they are more often created by the car manufacturer, who is concerned with the performance, comfort, economy, and the like of his product. On the basis of these fundamental considerations, the future automobile is foreseen to be more comfortable—lower, quieter, better ventilated—safer, more powerful, easier to drive; it will have greater variety in style and type to satisfy specific needs. The development of such a product is a challenge to the automobile industry. (Author's abstract.)

759. Engine design trends as related to gear lubricants. C. R. Noll. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 184–7.—As the rear axle gear lubricants now generally available at service stations are not considered by many in the automotive industry to be adequate to sustain present loads which result in high wear and scoring of gears, it is obvious that prompt improvement will have to be made in lubricants to take care of the requirements of present models as well as those we will be called upon to lubricate in the near future. Solution of the problem involves the interests and co-operation of four principals, *i.e.* the ultimate car driver, the car manufacturer, the oil companies, and the military. A recent proposal made to the automotive industry, which could serve as the means for reaching a general agreement, describes a method which would allow the various manufacturers to specify the max performance level required for their particular designs through the use of a sliding scale arrangement involving combinations of 2 different lubricants, one of relatively high and the other of low load-carrying abilities. Once determined, a test procedure could be developed to define the requirement. The first suggestion is that those concerned agree that one max level only is to be specified. The second suggestion is that those who might resolve this high speed level requirement, either through CRC or otherwise, should set the level at a point sufficiently high to take care of all passenger car requirements for at least 5 years in the future. (Author's abstract.)

760. Engine design trends as related to motor oils. M. L. Hamilton. *Proc. Amer. Petrol. Inst.*, 1956, **2**, 180–3.—There is at least one thing about new engine designs that is common to them all. They are developed in secret and they are in the hands of the public before the lubricant supplier has had an opportunity to determine whether his particular symphony of chemical additives will make harmony or discord in that theatre of fury and torture which is the crankcase of a modern high output I.C. engine. To begin a new oil development programme, one of the first requirements is a test engine and a test procedure which will reliably duplicate in the lab the difficulty which it is the objective of the programme to correct. Engine oil testing is usually of an endurance nature and engine tests for overall performance are frequently up to 500 hr duration. There exists a recognition of the problem of providing advanced test tools on which both industries, the automobile industry and the petroleum industry, can rely to keep better in step. The co-operative efforts of the 2 industries to attack problems of mutual interest finds expression in the programmes of the CRC, which is jointly sponsored by the SAE and the API. (Author's abstract.)

761. The advancing diesel. Anon. *Petrol. Press Serv.*, 1957, **24**, 365–9.—Unrivalled thermal eff of the C.I. engine has prevailed for 60 years. The gasoline engine—conceived primarily for road vehicles—established a virtual monopoly in this field and in aviation. Factors retarding the C.I. type of I.C. engines are high air pressures for effecting fuel self-ignition—calling for stronger, heavier, and bulkier construction—and a more intricate fuel injection method than its spark-ignition counterpart. These factors, apart from high initial cost, impeded small, light, and fast-running diesel development for automotive purposes, etc. The oil engine could assert itself only by sp advantages, *i.e.* high fuel economy, easy operation, immediate availability for service, virtual independence of water, and high pwr range. Potentialities of diesel pwr were shown by the advent of the world's first motor ship, Denmark's 7400-ton merchant vessel *Salandria*, in 1912. The largest marine diesels for single screw propulsion develop *ca* 15,000 h.p. Diesels developing 24,000 h.p. on a single shaft are projected. Post-war progress in evolution of medium-size and small high-speed units for rail, road, and farm uses has advanced the diesel in land transportation and agriculture. Equally important are the advances in performance and economy of large high-powered, slow-running marine and stationary oil engines achieved, *e.g.* by supercharging and by the expanding use of low-cost residuals in place of dist fuels. R. T.

762. Free-piston-engined ship in service. Anon. *Mot. Ship*, 1957, **38** (450), 364.—Results are given of the first voyage of the converted Liberty ship *William Patterson* with a 6000-s.h.p. free piston gas turbine as the motive power. Many photographs and diagrams are included. D. K.

SAFETY PRECAUTIONS

763. Automatic foam systems. K. Zimmerman. *Petrol. Engr*, 1957, **29** (5), D44–8.—An automatic system is designed to flood a pumping station with foam as a precaution against fire. The system is activated by a sharp temp rise. After the foam flow ceases, water sprinklers clean the pumping station by dispersing the foam down drains. The system is economical to install and easy to maintain. E. A. G. H.

764. Puncture plates speed foam application to tanks. L. Grossheim. *Petrol. Engr*, 1957, **29** (5), C27–31.—Installation of puncture plates in fixed-roof tanks provides adequate roof openings for the admission of foam at a sufficient rate to the oil surface in case of fire. The fixture is a revised roof manhole, and any type of foam tower may be used. Investment and maintenance costs are reduced. The roof openings provide better ventilation and light penetration during cleaning operations. E. A. G. H.

765. Monitoring of solvent–air mixtures with infra-red analysers. D. R. Simonsen and H. W. Crouch. *Industr. Engng Chem.*, 1957, **49** (10), 1741–3.—The use of i.r. analysers as a means of monitoring air–solvent mixtures in such cases where they may reach a hazardous level of toxicity or explosibility is discussed. The sensitivity of this method is examined, and the response of various i.r. analysers to mixtures of organic solvents, up to 9 in number, is given. D. K. R.

766. Reducing static electricity by radioactive material. J. J. Conradi, J. R. Miller, and J. J. Skelly. *Oil Gas J.*, 18.11.57, **55** (46), 199.—A progress report is given on lab and full-scale experiments using strontium-90–yttrium-90 as the radioactive source to function inside a storage tank to reduce static electricity by ionizing the vapour space and thereby producing a path through which the charge on the hydrocarbon itself can be discharged. G. A. C.

767. Generation and prevention of static electricity. Anti-static doping safeguards shipments of petroleum products. A. Klinkenberg. *Oil Gas J.*, 18.11.57, **55** (46), 204.—This is a paper given at API Meeting in Chicago on " Laboratory and Plant Scale Experiments on the Generation and Prevention of Static Electricity."

Addition of anti-static additive in order of 0·7 lb/1000 brl of product eliminates explosion hazards and permits increased pumping rates. G. A. C.

768. Static electricity in petroleum products. D. T. Rogers, J. P. McDermott, and J. C. Munday. *Oil Gas J.*, 18.11.57, **55** (46), 166.—Production of static electricity in hydrocarbon fuels is connected with presence of colloidal contaminants mostly organic in nature and resulting from treating operations. The contaminants ionize in the hydrocarbon environment. Tables shown include possible mechanism of charge generation; conductivity and decay rates, static electricity of certain products, and detection of electrical discharges, generation of static electricity, relationship between conductivity and static production effect of radiation; effect of high temp treatment, methods of removing contaminants, and mechanism of charge separation are considered among the many other aspects of the problem. G. A. C.

769. API research provides many answers. H. W. Field and C. E. Headington. *Oil Gas J.*, 18.11.57, **55** (46), 163.—A review is given of certain API projects, *e.g.* Project 6, which concerns the analysis, purification, and properties of petroleum hydrocarbons; Project 45 concerns synthesis, purification, and properties of hydrocarbons of low mol. wt. Other projects reviewed include 42, synthesis and properties of high mol.-wt. hydrocarbons and Project 48, on synthesis, properties, and purification of sulphur cpds in petroleum. G. A. C.

MISCELLANEOUS

770. The world oil situation—1956. S. A. Swensrud. *Proc. Amer. Petrol. Inst.*, 1956, **36** (4), 71–8.—It appears probable that we shall find continuing need for moderately increasing quantities of oil from other areas over the near-term future. Somewhere along the line, perhaps several decades hence, if and when U.S. productive capacity ceases to expand or actually begins to decline, we shall then need much greater quantities from other sources to meet the domestic demand. Industry studies as to the future ratio of reserves to consumption usually show reserves and productive capacity rising for a number of years ahead and then somewhere along the line beginning to drop off as the ability to find new reserves fails to offset the decline. It will require only a modest further increase in economic and industrial development to bring about a relatively large increase in oil consumption in many parts of the world. At whatever rate our need for outside oil may develop in the U.S.A., there can be no question of the dependence of W. Europe and many other parts of the free world on Middle East oil. In the kind of free world we visualize as necessary to avoid the threat of Communism and to be safe in a military sense, we must consider Middle East oil supplies for the free world as vital to our security. (Author's abstract.)

771. What to do with spent clay? G. F. Felton. *Petrol. Process.*, Sept. 1957, **12** (9), 160–1.—Uses developed for spent filter clay include reclaiming swampy land, foundations, and building of dykes and levees on the refinery site. Data on construction and performance of foundations are given. P. J. O.

772. Utilization and economics of fuels in Italy. C. Padovani. *Riv. Combust.*, 1957, **11** (7–8), 429–65.—The main features in the evolution which has taken place in Italy over the past 35 years are reviewed. Particular stress is given to the following changes: (1) the continual rise in total power and heat consumption has been especially marked in recent years, although the *per capita* demand is still notably below that of most industrialized countries; (2) despite intensive exploitation of water power and natural gas, Italy still depends, as it did 35 years ago, on imported fuels for more than 60% of her overall power requirements; (3) imported finished products have been increasingly ousted by imported crude fuels for further processing in Italy. Coal has played an increasingly smaller part in Italy's power supply, especially of late years, natural gas and petroleum now enjoying the preference. (Author's abstract.)

773. Organization of oil industry in Poland. J. Wojnar. *Nafta (Krakou)*, 1957, **13**, 87–94.—In the face of yet another reorganization due to the abolition of the Central Office for Petroleum, which took place on 22 March 1957, the author reviews the structure of the industry as it was in Dec. 1956. Starting with July 1944, when the National Petroleum

Office was established, the history of the administrative changes is traced through the following 12½ years. The trend which was evident from the start was that the oil industry administrative bodies, conceived as a part of some ministry or department, became in succesion so big and important that they had to be assigned an independent position. At the same time the several parts of the Central Executive of Petroleum Industry grew bigger and were either transferred as such to some department, *e.g.* gas industry, or were given a certain degree of independence, *e.g.* refining. The C.O.P., directly responsible to the Prime Minister, was established in April 1955. Apart from the technical divisions it included planning, education, and safety divisions. All are described, giving their strength and number of works in them. The total employed is 29,528 people, including 8232 members of the staff. M. S.

774. Predicting V–L equilibrium data. H. H. Yang. *Petrol. Refin.*, 1957, **36** (9), 296–300.—A new hypothesis, derived for non-ideal binary systems, which permits the graphical determination of vapour–liq equilibrium under isothermal conditions is presented. This hypothesis states that the partial pressures of the components of a system at constant temp may be considered as the partial molar properties. Existing evidence shows that the hypothesis holds satisfactorily for binary systems with moderately non-ideal behaviour, but more experimental evidence is needed to prove its general validity. J. R. T.

775. Who's who in petroleum service firms. Anon. *Petrol. Process.*, Sept. 1957, **12** (9), 149–52.—A glossary of American consulting, design, and engineering firms and their subsidiaries gives details of services offered by each, addresses, and main personnel. P. J. O.

776. How to sell petroleum products to the construction industry. D. S. Robertson. *Proc. Amer. Petrol. Inst.*, 1956, **36** (2), 188–93.—With approx 3 million pieces of major construction equipment requiring fuels and lubricants and the construction industry now experiencing a boom, the consumption of petroleum products in this field approaches a fantastic figure in quantity and dollar value. The building, highway, and other types of construction will spend $350–$400 million in 1956, and the prospects for 1957 are even greater. The industry requires better service than that currently provided by the petroleum companies with respect to the quantity and availability of products to improve the efficiency of equipment and reduce servicing operations; engineering help on the more difficult problems, especially in lubrication, and recommendations concerning the use of products; and additional reliable information which would help to improve maintenance practices. From the marketing point of view, a sales campaign should be aimed at each and every group concerned with the construction business—the contractors, the consultants, the government construction men, and the owner's staff engineers. The men who are responsible for making purchases, and, therefore, who make the best targets for product sales are, first of all, the top echelon of management, *i.e.* owners, presidents, and so forth; followed by superintendents, managers, or foremen; and finally, the maintenance people who constitute a smaller, but still a very important group. The construction market is an open market, not dominated by one or two companies, and the individual petroleum concern's share of this market depends on the services it has to offer to satisfy its needs.
(Author's abstract.)

777. Tenth anniversary of Technical School for Petroleum Industry in Krosno. M. Mojak. *Nafta (Krakow)*, 1957, **13**, 111–12.—Taking its root in the first ever Mining School for Petroleum Industry, established by Lukasiewicz in 1878, this technical school established in March 1947 has already produced 360 trained men and women who are employed in the industry. Expansion is proposed to make it possible for 200 more to reside and study there. Curriculum, which covers 4 years, is to be extended to 5 with the aim of producing better trained school-leavers. The level of teaching is that of a secondary school. M. S.

778. The quality of mercy. G. N. Hebert. *API Quart.*, Summer 1957, 24–9. A vivid, illustrated account of oil company efforts—by men, machines, and money—to aid those stricken by the recent Louisiana disaster. R. T.

779. The figure in the flames. E. Behrenat. *API Quart.*, Summer 1957, 8–13.—A vivid, illustrated article on theories and methods of extinguishing oil well fires, with special reference to Myron Kinley's technique. R. T.

780. We land at the Pole. G. J. Dufek. *API Quart.*, Summer 1957, 2–7.—An illustrated account of U.S. operations in the Antarctic. Each station must have a 2 years' supply of food and fuel—fuel for heat, power, surface transport, and aircraft operations. Estimated annual fuel requirements for heating and surface transportation was 1,059,866 gal diesel oil, and 230,200 gal motor gasoline. An annual supply of 1 million gal of aviation gasoline was needed to supplement drum storage. For bulk storage two-100,000-gal and two-250,000-gal steel tanks welded *in situ*, and 2 storage barges of 270,000 gal capacity were used. For transfer of bulk fuel from the tank ship several miles of hose, pumps, and rubber tanks were used. The operation "Deepfreeze," and building of South Pole bases, would be impossible without petroleum. R. T.

BOOK REVIEWS

Instrument Technology, Vol. III. Telemetering and Automatic Control. E. B. Jones. London: Butterworths Scientific Publications. Pp. x + 198. 40*s*.

The instrument industry has expanded so rapidly during the last decade that "instrument engineering" or "instrument technology" is rapidly developing a claim to rank as a major subject, along with electrical, mechanical, or chemical engineering. It has been, and still is, a paradise for inventors and might easily become a nightmare for students owing to the number of mutations of each species and genus. Even though Nature's pruning knife ensures the survival of the fittest inventions—with greater efficiency than it controls human destinies (no Welfare State or other non-Darwinian interferences!)—the mass of information which has to be absorbed remains formidable. Only by a proper combination of classification, principle, and selected practice can chaos be avoided.

Mr Jones, in his third and final volume, has again shown his wide grasp of the subject. Telemetering, and the theory and practice of automatic control, with emphasis on the process industries, are covered lucidly and with copious line drawings and photographs. The almost total absence of mathematics reflects presumably the author's conviction that the average English reader is ill-equipped. He is probably right. But in that case should we not drop the euphemism and say that he (the student) is badly educated?

It is probably unfair on the part of the reviewer to indulge

in a frontal attack on text-books in general when reviewing a particular volume. But how much pleasure does one derive from reading, as distinct from consulting, a text-book written in the modern antiseptic style? Clarity and precision are not enough. We are surfeited with them in manufacturer's instruction manuals and inter-office memoranda. If the purpose of a text-book be to educate as well as to instruct or train, the author's first problem is one of imagination. The student is a temperamental receiver in a complex telemetering system. Will he be excited or will he go to sleep? A lecturer soon finds the answer unless he is insensitive to feedback. Modern scientific writers do not seem to recognize the problem. Have they forgotten Russel, Jeans, Eddington, Wood, and Darrow, none of whom were afraid to put a personal stamp on everything they wrote?

"Instrument Technology, Vol. III" is a compact and well illustrated text which will be a "must" for students and a useful addition to a petroleum technologist's library. An appendix containing questions set in the City and Guilds examinations is a welcome feature. G. C. E.

Industrial Lubrication Practice. New York: Industrial Press; Brighton: Machinery Publishing Co., 1957. Pp. x + 550. 75*s*.

Having drawn attention in his preface to the phenomenal increase over the past ten years in publications devoted to lubrication, the author offers yet another text-book on industrial lubrication so soon after Forbes, Pope, and Everitt's "Lubrication of Industrial and Marine Machinery" in 1954 and Brewer's "Basic Lubrication Practice" in 1955. Indeed, the contents pages of all three books are so similar as to lead one to fear the worst. There is, however, a wealth of practical detail in the present book that justifies its appearance and makes it a useful addition to the lubrication library.

The emphasis throughout the book is on practice and, as the author proclaims, theory is but lightly touched upon. Indeed, so light is the touch that the theory is in parts somewhat naïve and misleading, and it would be no great loss to skip the first 49 pages and start at Chapter 5. The inclusion of E.P. additives and castor oil—with an acid radical at one end of the molecule—under solid lubricants is distinctly unusual, as is the use of the terms tacky or adhesive additives as synonymous with oiliness additive. It is regrettable also to find a repetition of the popular fallacy that detergent additives and oils have a "washing effect" that dislodges gums, resins, and deposits. It is perhaps not so surprising to find the common mistakes of calling dynamic viscosity "absolute," as opposed to the kinematic viscosity, and of omitting the terminal "S" from the unit "Stokes." It is, however, scarcely true nowadays to say that capillary viscometers are seldom used for commercial purposes as being too delicate and inconvenient and that some type of a can with a hole in the bottom is the preferred instrument.

These and other defects in the minor theoretical part are, however, compensated by the merits of the major practical part with its detailed description of machines and equipment and its sound practical recommendation regarding their operation. The author is well aware that many of the troubles with which the lubrication engineer has to deal may arise from defects in design, construction, or operation rather than from faults in lubrication; for this reason he does not confine himself narrowly to lubrication aspects, but deals helpfully with these other factors in an endeavour to give an overall picture of the working of the mechanism in question. This he does in sixteen chapters ranging from hydraulic systems through internal combustion engines to chains, ropes, and couplings. In the three chapters dealing with internal combustion engines the author goes beyond his title to include much useful information about automotive engines and their lubrication. In the diesel section reference is made to the use in marine diesels of bunker fuels with sulphur contents up to 3·5% wt and the wear problems thereby incurred. This being a problem little known in American marine practice, it is perhaps not surprising that no mention is made of the successful use of emulsion lubricants in combating wear in such engines.

Chapters are devoted to the storage and handling as well as to the purification and reclamation of lubricants, although it is concluded that reclamation is always expensive and seldom economic. A chapter is devoted to the organization of a lubricants department and orderly and systematic schemes of lubrication for which one person should be responsible are strongly advocated. In addition, however, the user is recommended to make full use of the lubrication service which all major oil companies freely provide.

The book is well concluded by a useful collection of conversion tables and blending charts, a glossary, and a comprehensive index in which assistance is given to the reader by placing page references to any item in the order of their importance. W. P.

Steinsalz und Kalisalze. Fraz Lobze. Berlin: Gebruder Borntraeger, revised edition, 1957. Pp. xi + 466. DM. 58.80.

This clearly printed and liberally illustrated volume deals comprehensively with all phases of mineral salts found in nature throughout the world in the form of sediments, evaporites, efflorescences, or otherwise. The composition of the many minerals that have resulted from differential evaporation of saline waters is followed by an account of the widely distributed recurrence of fossil salt during past geolcgical epochs extending from the Cambrian period to the present day. The many depositional factors involved and the metamorphosis suffered by salt during terrestrial tectonic movements are described. To the oil geolcgist most interest centres on the influence of rising salt masses on the rocks that border or surround the intrusion and the opportunities afforded for the concentration and preservation of petroleum in inflected or attenuated permeable beds above or near the zone of contact. The many figures introduced to illustrate the effect of salt intrusions on the formations they pierce give a vivid impression of the rupture or dislocation sedimentaries suffer in the process of being squeezed. Sectionized examples of salt domes in the Gulf Coast region of the U.S.A. and in West Germany very clearly depict the different reactions of salt on young pliable unconsolidated sediments of Texas and Louisiana and the indurated and less yielding strata of greater age found in Germany. The bulging of a rising salt mass on meeting less lateral resistance on approach to the surface, and the formation of diapiric structures on its edges are examplified by sections of the Baicoi and Tsintea, Moreni, and Ochiuri oilfields of Rumania. The involutions of strata caused by erratic bodies of crumpled salt are exhibited in a number of sections that are bewildering in their complexity.

The relationship between fossil salt and petroleum covers only 9 pages from 377 to 385, where a single illustration shows how the salt mass has influenced the selection of well sites for oil production in the Moreni oilfield of Rumania, where the overhang of salt is considerable. A formidable bibliography of 79 pages gives an indication of the amount of literature bearing on a subject which must interest many. A. B-T.

Über die Wirkstoffe in Legierten Motorenoelen. Augsburg: Verlag für chemische Industrie H. Ziolkowsy, 1957. Pp. 92. DM. 7.50.

Professor Kadmer is well known for his contributions to the theory and practice of lubrication and is the author of a comprehensive text-book "Schmierstoffe und Maschinenschmierung" (1941), which was one of the first to appear out of Germany after the second world war.

The present publication, although small in size and volume is a mine of information on the most important types of additives used in modern engine oils. English practice does not recognize the term "alloyed oils" (legierten oelen); "compounded oils" is restricted to blends of mineral and fatty oils; "additive oils" usually refers only to detergent, H.D. oils, and the like, as do the objectionable terms "doped oils" and "doping." None of these is used in the general sense of "additive-containing oils" to include all that vast range of additives from detergent to anti-foam that are commonly used to-day. The author deliberately uses the term "alloyed" and draws an analogy between straight mineral oil and iron as against "alloyed oil" and steel, in which the various additives used in the oil correspond to the range of alloying metals used in steel.

Viscosity index improvers, pour point depressants, oxidation and corrosion inhibitors, detergents, rust preventives, anti-foaming agents, and E.P. additives are successively dealt with. In each case a general review of their nature, historical development, mode of action, and supplier is given, together with extensive references to the patent and general technical literature. Even the non-German reader could without much difficulty abstract considerable information from the tables of composition and properties given under each type of additive, but an English edition would undoubtedly be welcome. W. P.

ADDITIONS TO THE LIBRARY

Entries are in subject order arranged according to the Uren "Classification for Petroleum Bibliography," the number preceding each entry indicating the classification and corresponding to that used in the "Library Catalogue" published by the Institute.

030 Department of Scientific and Industrial Research. *Fuel Research Board.* Fuel research 1956: report of the Fuel Research Board with the report of the Director of Fuel Research for 1956. London, HMSO, 1957. 80 p.

080 British Chemical Plant Manufacturers Association. British chemical plant 1957. London, BCPMA, 1957. 402 p.

080 Society of Chemical Industry. Buyers' guide of chemicals, chemical plant, laboratory equipment, and apparatus, 1958. London, SCI, 1957. 180 p. Supplement to "Chemistry and Industry" December 7, 1957.

080 Standard Oil Company (New Jersey). The Jersey Standard story. New York, Standard Oil Co., 1957. 74 p.

090 American Petroleum Institute. Airport fuelling systems. New York, API, 1954. 6 p. (Bull 1505.)

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OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

781. Discovery spurs Pecos play. Anon. *Oil Gas J.*, 2.9.57, **55** (35), 99.—1 Hokit 2 in Pecos County, W. Texas, on test flowed 740 b.d. from the Ellenburger at *ca* 11,400 ft. The well is sited on the Sheffield channel, a buried feature thought to link the Delaware and Val Verde basins. It is an area of deep sedimentation in which there has been sparse drilling. A number of wells are now being drilled in the area as part of a plan to find pre-Permian oil. C. A. F.

782. Natchez area production. Pt 2. G. W. Gulman, H. E. Hansen, and B. L. Simms. *Oil Gas J.*, 26.8.57, **55** (34), 112.—Mississippi and Louisiana oilfields of the Natchez area of the Gulf Coast are listed, together with data on type of structure, number of wells, production to Nov. 1956, and stage of development.

H

The Wilcox fields are usually areally small but have recoveries up to 1000 brl/acre-ft. Detailed stratigraphic studies are the best means of locating these fields.

The Natchez area is of particular interest because of low drilling costs, high recoveries, and shallow to intermediate drilling depths. C. A. F.

783. Dakota test hits. Anon. *Oil Gas J.*, 19.8.57, **55** (33), 108.—1 Kalanek in Stark County, N. Dakota, on test of the Nesson–Mississippian at *ca* 8800 ft, recovered oil and gas-cut mud. The well is 26 miles NE. of the recently discovered Rocky Ridge–Heath field and is *ca* 20 miles from the nearest production in the Belfield pool. C. A. F.

784. Wildcat fever breaks out over wide Williston area. J. C. McCaslin. *Oil Gas J.*, 2.9.57, **55** (35), 219.—There have recently been important discoveries in the Williston basin in Montana and N. and S. Dakota. These are reviving exploration in the area, and new and deeper pays are being found. The first of these recent finds was in 1 Tange in NE. Montana, which flowed 2742 b.d. from the Silurian, and several producers have since been completed. Subsequently discoveries were made at Ruegsegger and Loucks, and in N. Dakota a deep well in the Beaver Lodge field found Ordovician, Silurian, and Devonian gas sands. A wildcat in Billings County flowed up to 1400 b.d. from the Heath sand, and a recent well has indicated Mississippian Nesson pay in Stark County.

In spite of new deep pays the Mississippian remains the main objective in the area. C. A. F.

785. 13 may be fateful. F. J. Gardner. *Oil Gas J.*, 9.9.57, **55** (36), 159.—The producing fields of the Denver basin of Colorado show a scattered distribution, and to date random drilling has been the most satisfactory means of exploration. Seismic work and surface and subsurface geology have not proved reliable. There are 2 targets, the Lower Cretaceous Dakota D and J sands, and over most of the explored area accumulations are controlled by lithological variations.

Wildcat density is high in the N. central part of the basin, but the flanks have been much less intensively tested. 13 wildcats are now being drilled in these areas, and if successful there should be a revival of activity in the basin. C. A. F.

786. Oriskany looks promising in Eastern West Virginia. P. H. Price, R. C. Tucker, and O. Haught. *Oil Gas J.*, 16.9.57, **55** (37), 345.—The Oriskany sand has been an important pay in W. Virginia, and it is thought that many productive areas still await discovery, especially in the E., where there is strong folding and fault blocks occur. Recent drilling in this area has shown that structure at depth differs appreciably from that at surface, and exploration should be supplemented with geophysical data.

There are 2 main types of Oriskany accumulation. In the Elk–Poca area in the W., the main Oriskany producing area, the gas is wet and occurs in stratigraphic traps, but in the E. the gas is dry and production appears to be controlled by fractures in well-cemented sand in anticlinal structures. C. A. F.

787. Dry-hole graveyard to major province. N. S. Morrisey. *Oil Gas J.*, 9.9.57, **55** (36), 84.—Since the discovery of the Aneth trend, the Utah part of the Four Corners area of the U.S.A. has become an oil province with estimated reserves of over 500 million brl. The trend has developed into a producing area trending 11 miles in length and 4 miles wide, with reserves estimated at at least 250 million brl. Production has also been found in neighbouring areas, with the centre of activity in San Juan County, Utah. Pays are Pennsylvanian Hermosa and Paradox limestones, and it has been suggested that accumulations are due either to stratigraphic trapping on a large scale or to reef accumulations with many individual fields on local structures.

The geology of the area is described. There are 3 pronounced basins, Blanding, San Juan, and Black Mesa, which are separated by prominent uplifts, and structure and stratigraphy are complex.

Drilling costs in the Aneth area are high because of inaccessibility, severe climatic conditions, and lack of water. C. A. F.

788. Mississippian oil comes to Utah. N. S. Morrisey. *Oil Gas J.*, 16.9.57, **55** (37), 343.—Only one commercial Mississippian oilfield has been found in Utah. This is the Big Flat field, where the first commercial well is being completed; on test it produced up to 345 b.d. from *ca* 7700 ft. Big Flat is a surface anticline in an area which is relatively unexplored. There are many large surface anticlines which are due to salt movements. Most of the deep tests in the area have been drilled on the crests of these structures, but only a few have penetrated the Mississippian limestone. C. A. F.

789. Geological study shows Cambrian and Ordovician oil possibilities for Indiana. A. M. Gutstadt. *Oil Gas J.*, 2.9.57, **55** (35), 216.—The results of a geological study of the oil possibilities of the Cambrian and Ordovician in Indiana are summarized. The section consists of the Mt Simon and Eau Claire formations at the base, and these are overlain by the Knox(?) dolomite, St Peter sandstone, Black River limestone, Trenton limestone, and the Cincinnatian and Maquoketa shale. The possibilities of each of these are noted; to date production has been found mainly in the Trenton, with some production from local permeable zones in the Black River. A small amount of gas occurs in the Cincinnatian and Maquoketa, and there are many shows in the Knox. Diagrams show facies changes across the state and the structure of the Trenton. C. A. F.

790. Wyoming still abounds with wildcat prospects. J. C. McCaslin. *Oil Gas J.*, 23.9.47, **55** (38), 171.—Wyoming is the largest producing state in the Rocky Mountain area of the U.S.A., and although a large number of fields have been found, there remain many prospective areas. The most inviting are in the Powder River, Hanna, Green River, and Wind River basins.

In the Powder River basin production has come mainly from the SW. and E. sides and there has been little activity elsewhere, but recent discoveries of Cretaceous and Pennsylvanian production at Donkey Creek in the NE. and Dead Horse Creek in the centre of the basin have encouraged operations in these areas.

In the Hanna basin Jurassic Sundance production has been found at East Elk Mountain, the wildcat producing 175 brl/hr on test.

Increased drilling in the Green River basin is predicted, following a discovery in the Mesaverde at Big Piney.

A deep wildcat is being drilled in the Wind River basin 4 miles SW. of Iron Creek. C. A. F.

791. Washington—new oil-producing state. F. J. Gardner. *Oil Gas J.*, 2.9.57, **55** (35), 215.—After many years of unsuccessful drilling and the abandonment of marginal discoveries, a commercial producer has been drilled in Washington, U.S.A., near Ocean City on the Pacific coast. The well, 1 Medina, on test of the Lower Miocene Nye at *ca* 3900 ft, flowed *ca* 400 brl. Much leasing followed the discovery, and on later completion the well was flowing at 223 b.d.

This is the eighth wildcat to be drilled on the Ocean City anticline, which trends NNW.–SSE. for some 3½ miles. It is broken by 2 faults, and was first located by seismic and subsurface studies. C. A. F.

792. Will these sedimentary basins prove oil bearing? W. B. Gallup. *Oil Gas J.*, 19.8.57, **55** (33), 142.—The oil possibilities of sedimentary besins lying along the NW. coast of N. America are described; these are the Georgia basin, the Hecate basin, and the Gulf of Alaska basin. All of them form part of a major downwarp along the W. coast of the continent in which Palæozoic, Mesozoic, and Tertiary sediments were deposited.

In the Georgia basin, which lies clcse to the Canadian border, the beds range from Mesozoic (undivided), through Upper Cretaceous and Tertiary. The Tertiary beds seem to be thick, and structural conditions are favourable with evidence of recent movements.

In the Hecate basin, which lies to the N. and involves the Queen Charlotte islands, the beds range from unaltered Jurassic to Tertiary. Oil seeps are known from several localities.

The Gulf of Alaska Tertiary basin is the largest of the group, and it lies to the N. of the Hecate basin, extending NW. to the Cordova area in Alaska. Only a narrow strip is now present above sea level, and this comprises Tertiary beds outcropping along the coast, flanked inland by Cretaceous rocks. Structures are complex, and oil seeps are common throughout the area. A small amount has been produced from the Tertiary E. of Cordova, where 4 wells were drilled into the Sullivan anticline. There are good prospects for stratigraphic traps.

It is concluded that each basin offers prospects for exploration. Thick sections are present, and marine facies are developed in each area.

Cross-sections of the basins are given. 15 refs. C. A. F.

793. Fort St John sets pace for Peace River gas fields. L. M. Clark. *Oil Gas J.*, 19.8.57, **55** (33), 132.—Many important gas fields have been found in the Peace River area of Alberta and British Columbia since active exploration started in 1951. The largest field is Fort St John, found in 1952, and this was followed by the discovery of many gas and several oilfields.

The geology of the area is outlined; the sedimentary section is the thickest in the W. Canada sedimentary basin, reaching over 14,000 ft, and there are at present 19 productive zones ranging from Middle Ordovician to Upper Cretaceous. In British Columbia the gas is mainly sulphurous, with a high content of natural gas liq, but in Alberta it is mainly dry and sweet.

The Fort St John field is an anticline with closure of *ca* 150 ft and a productive length of *ca* 20 miles. C. A. F.

794. Is Red Earth a major oilfield? R. R. Roethke. *Oil Gas J.*, 19.8.57, **55** (33), 157.—Since oil was found in 1956 in granite wash in the Red Earth wildcat, *ca* 220 miles NW. of Edmonton, Alberta, there has been considerable interest in the oil possibilities of this relatively new pay in an area where only a few widely scattered wells had been drilled. The development of this discovery is described, together with the geology of the field. 9 wells have been drilled into the wash, which overlies the pre-Cambrian granite, at a depth averaging *ca* 4750 ft, and it varies in thickness from 122 ft down to zero. It consists of sand, shale, and silt, and there is much lateral variation.

On test production the field has produced 24,000 brl from 3 wells during the winter months, 1956–57.

It is anticipated that Red Earth will prove to contain important reserves and exploration will require combined geological and geophysical methods. The distribution of the wash is controlled by the irregular granite surface, and the oil occurs on the flanks of granite highs. C. A. F.

795. Both structure and stratigraphy beckon in SE. Saskatchewan's Mississippian fields. R. W. Edie. *Oil Gas J.*, 19.8.57, **55** (33), 178.—Primary recoverable reserves of the Mississippian in SE. Saskatchewan are estimated at 500 million brl, but as most of the fields are under development, ultimate reserves will be greater. Structural and stratigraphic traps are believed to exist. Structural influence appears to be the main control in such fields as Ratcliff and Torquay, and the Mississippian erosion surface contains stratigraphic traps such as those along the Alida–Nottingham trend. Seismic work has been useful in exploration for both of these trap types, together with facies studies of the subsurface for locating stratigraphic traps.

The geology and oil possibilities of the area are reviewed and the geology of the fields outlined. Cross-sections and diagrams illustrate the geology of the area. C. A. F.

796. Rockies prospects are being drilled. C. W. Hunt. *Oil Gas J.*, 19.8.57, **55** (33), 191.—Structures in the Rocky Mountains of Canada are attractive prospects, but exploration has been retarded by high drilling costs, uncertain sub-surface structural conditions, and the lack of markets for gas. A major gas field has been found at Savanna Creek, and there have recently been 2 discoveries in the foothills, Shell Waterton Park and Gulf Mountain Park, as well as several failures. These discoveries have been based on seismic and surface mapping, but it is emphasized that new techniques are required for successful exploration in the area. The accurate construction of interpretative cross-sections is stressed and a method of quantitative profile analysis is proposed. This is described in detail and an example is given. It is based on the assumption that during uplift, folding, or faulting no appreciable volume of rock is created or destroyed, and a planimeter is used so that, in the construction of the profile, each stratigraphic unit bears a constant ratio to the sum of the contributions of all stratigraphic units represented, regardless of the geometry of folds and faults present within the given profile. C. A. F.

797. Canadian geologists may have the last laugh. F. J. Gardner. *Oil Gas J.*, 19.8.57, **55** (33), 289.—There have been important gas discoveries W. of Pincher Creek, Alberta, at Waterton and Castle River. Both wells on test flowed gas from pays in the Mississippian Rundle which are over 750 ft in gross thickness. Additional wells are being drilled in the area, which emphasizes the growing interest in the possibilities of the Rocky Mountains and Foothills areas.

Another well, at Stolberg *ca* 250 miles NW. of the Pincher Creek area, has also found gas in the Rundle at *ca* 11,500 ft.

The geology of the area is complex, but it should have an important future. C. A. F.

798. Champlin closes deal in Panama. Anon. *Oil Gas J.*, 16.9.57, **55** (37), 118.—A concession in Panama covering some 870,000 acres in the NW. part of the country near the border with Costa Rica is to be explored. *Ca* ¾ of the area is submerged in lagoons and bays and wells are to be drilled in 1958 in the Laguna de Chirique. Seismic work has already been carried out and oil prospects are reported to be good. There has also been some surface work and aerial photography.

Sediments are reported to be at least 12,000 ft thick and there are numerous structures. C. A. F.

799. Israelis find gas. Anon. *Oil Gas J.*, 9.9.57, **55** (36), 80.—A wildcat 11 miles S. of the Heletz field in Israel has found gas and is to be tested. Structure drilling is to be carried out in the Beeri area.

N. of the wildcat, 2 Brur has been completed for production at 5000 ft. It is believed to be in a separate pool on the Heletz structure. C. A. F.

800. Japan gets strike. Anon. *Oil Gas J.*, 19.8.57, **55** (33), 120.—A well in the Tamugiyama area of Niigata, Japan, is

reported to have produced on test at a rate of over 500 b.d. Total depth is 3700 ft.

Total production of Japan is 6000 b.d. from over 3500 wells, mostly producing from shallow sands.

Exploration is being carried out for deeper sands, and there has been some success in the Yabase field, the largest in the country. C. A. F.

801. Aquitaine fans fresh interest: French basin yields strike. Anon. *Oil Gas J.*, 2.9.57, **55** (35), 106.—A well in the Aquitaine basin of SW. France, *ca* 22 miles NE. of the Lacq gas field, has produced on test gas and medium-heavy oil. This is in a new area of the basin, where 6 deep tests have recently been drilled. There are now 5 fields in the basin which are producing: Parentis, Lacq, Mothes, Lugos, and Lucats. C. A. F.

802. Oil possibilities of the Sub-Alpine zone. M. Orgeval and M. Zimmermann. *Rev. Inst. franç. Pétrole*, 1957, **12** (5), 515–42.—The area of the dome of La Mure includes beds of Triassic and Liassic age, not all of which occur over the entire dome, and the Trias rests on the basement. The beds are variable. They include limestones, sandstones, marls, shales, and some lava flows. There is evidence that the facies are linked with the dome, pointing to structural movements during sedimentation. There are possibilities of reservoir rocks, although some may require fissures to be effective.

Beds of Carboniferous, Triassic, and Liassic age are involved in the Laragne anticlinorium. There are evidences of oxidized bitumen and numerous H_2S shows. The anticlinorium may reflect a basement high. In the Die anticlinorium there are important differences in the thicknesses of the beds. In both areas the structural details described are defined by black plastic beds, and it is possible that the deeper limestones may show less strong features.

The gravimetric and geological maps have been compared, and the former indicates the Die anticlinorium. An aerial magnetometer survey had to be flown at 2000 m, and although the sensitivity was too low for certainty in interpretation, some known features could be recognized.

There seem to be thick source rocks in the Carboniferous (variable and irregular in its occurrence), Jurassic, and Cretaceous. Oil is known in the Permian at Coulobres and gas at Loiras; Jurassic dolomites are impregnated at Chabrières.

There is a list of the hydrocarbon shows, and also a list of the main fossils in the black marls. G. D. H.

803. Ostracods from the Upper Jurassic of the Paris basin (Well Vernon 1). H. J. Oertli. *Rev. Inst. franç. Pétrole*, 1957, **12** (6), 647–95.—Well Vernon 1 was drilled near Vernon, 80 km NW. of Paris, with a view to developing a subterranean storage reservoir for gas. The greater part of the Upper Jurassic was continuously cored. The stratigraphic terms are based on Arkell's studies. Excellent microfauna were obtained from the Lower Kimmeridgian, and 3 subdivisions are made. 40 ostracod species are described, 9 being new. There are 3 new genera (*Galliaecytheridea*, *Metacytheropteron*, and *Vernoniella*) and one new sub-genus (*Merocythere* of the genus *Amphicythere*). *Galliaecytheridea* belongs to the subfamily of *Cytherideinae*, and is close to *Clithrocytheridea*. *Vernoniella* belongs to the same sub-family. *Metacytheropteron* belongs to the family *Cytheridae*.

The ranges of the forms are shown. All the forms are illustrated. G. D. H.

804. Application of higher derivatives of gravity in gravimetric interpretation of Polish regions. Z. Fajklewicz. *Nafta* (*Krakow*), 1957, **13**, 149–52.—First, second, and fourth derivatives have long been used to identify gravimetric anomalies. The latter 2 are commonly used in the Polish Lowlands, which are characterized by their thick, irregular Diluvian cover, and for that reason the first derivative, $\frac{\partial g}{\partial z}$, is preferable. However, due to the need for fewer points, $\frac{\partial^2 g}{\partial z^2}$ or even fourth derivative is frequently used in spite of the inherent inaccuracy. Similar troubles exist in the Carpathians. Fuller analysis of Skorka region is presented in *Acta Geologica Polonica*, 1956, (4), **6**. M. S.

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

805. Velocity surveys aid in seismic interpretation. C. H. Thurber. *World Oil*, 1957, **145** (6), 78.—Velocity surveys in wells can be carried out by the conventional geophone survey, in which small charges are exploded in shallow wells and travel times to a geophone in the well are measured, or by the recently developed acoustic logging device, which provides a continuous record of variations in velocity with depth. The latter has become the accepted means of obtaining reliable velocity data for interpreting seismic records, and it can be used for correlation, as well as in the study of porosities and saturations. In this method the tool transmits a pulse which is reflected back from the formations to a receiver and the travel time is measured and plotted continuously as the tool is moved in the borehole. Times are plotted in microsec and may be recorded as interval velocities or travel times. Examples of acoustic logs are given. C. A. F.

806. Measurement of seismic velocities on cores: description of the apparatus constructed by the Institut Français du Pétrole. R. Chavet *et al.* *Rev. Inst. franç. Pétrole*, 1957, **12** (6), 715–29.—Apparatus has been constructed for lab measurements of the velocity of seismic waves in core specimens 7–10 cm long and 3 cm dia. The seismic impulse is provided by a quartz crystal energized by an electrical impulse, and detected and converted to an electrical impulse by a second quartz crystal attached to the other end of the specimen. The form of the wave is displayed on an oscillograph tube, and means are provided for measuring the time of transmission of the wave. The apparatus is designed for use at pressures up to 1000 kg/sq. cm., and temp up to 130° C. Pressure is applied by oil injection into the stainless steel cell housing the specimen and emitter and receiver.

The various electrical circuits are described with the aid of wiring diagrams, and the construction of the specimen holder and cell is shown. G. D. H.

807. Seismic data processing is a new exploration tool. K. E. Burg. *World Oil*, 1957, **145** (6), 75.—Magnetic recording of seismic data has become an established technique in seismic work because of its many advantages, which have been extensively described. It is emphasized that the technique is not an end in itself, but is a means to an end which is the most effective yet provided for oilfield exploration. The evolution and advantages of the method are discussed briefly, and it is shown that its effectiveness depends on the qualities of the originally recorded data and the processing equipment and techniques. Data processing is still under development, but already it has become an invaluable tool to the geologist and geophysicist. C. A. F.

808. Measurements of the speed of elastic waves in various rocks as a function of pressure and temperature. D. S. Hughes and C. Maurette. *Rev. Inst. franç. Pétrole*, 1957, **12** (6), 730–52.—Apparatus is described for the measurement of the velocities of dilational and rotational waves, through cylindrical rock specimens. Quartz crystals were used to create and detect the waves. Measurements were made at a series of

pressures up to 8000 bars, and at temp up to 300° C and even 400° C. 3 granites, 3 gabbros, a basalt, and 2 dunites were examined, in addition to Solenhofen limestone, a sandstone, a marble, and clayey limestone.

Various fluids (gases, oils, and silicone fluids) were used for transmitting pressures, the choice depending on the physical conditions.

For Woodbury granite the velocities were lower the higher the temp, and increased with increase in pressure, the change being most rapid in the low-pressure range. Detailed results are tabulated for the various specimens. Conversion of the data to relate the velocities of the longitudinal waves and the depth of the rock shows for some of the igneous rocks a velocity max at depths of 5–12 km, but in other cases there was increase with depth to 15 km (the lowest point shown for these rocks), although the rate of increase had diminished with depth.

The rock specimens are described. G. D. H.

809. Dipmeter curve comparator: an optical aid to the interpretation of dipmeter data. M. Ferre and R. Kinnaird. *Rev. sci. Instrum.*, 1957, **28**, 690–3.—The comparator is an optical instrument forming 2 separate, differently coloured images of a dipmeter log. By moving one image longitudinally and the other transversely any 2 points on the log can be superimposed Thus one dip curve can be optically superimposed upon another, the displacement can be directly measured, and the orientation and slope of the strata can then be computed in the usual way.

Allowing for a max displacement of 3 inches across the log and one inch along the log, the movement of the mirror is worked out. The required measurement is given directly on a dial, assuming that the log has been recorded on the usual scale of 1 : 20. For an actual depth shift in formation of $\pm 0{\cdot}1$ in the instrument must be able to resolve an angle of *ca* 0·03°. H. C. E.

DRILLING

810. Drilling and completion practice. A. S. Murray. *Engng J., Montreal*, 1957, **40**, 1253–8.—In 1956 >$268 million was invested in new W. Canadian wells. This represents >60% of the market val of crude oil and gas production for that year. The drilling industry employs 99% Canadians, and 75% of drilling costs stays in the drilling province. To replace 1 billion brl production over the next 5 years 10,000–15,000 exploratory and development wells must be drilled. Between 1947 and 1956 over 17,000 wells = >71 million ft have been drilled in the W. basin, and the surface is scarcely scratched. The main procedure for drilling oil wells and for their final completion is described, with particular ref to practice in the W. Canadian oilfields. A schematic diagram of a rotary rig is shown. Efforts to increase production by well stimulation are described. Drilling costs are often high and technological improvements to reduce them are discussed.

R. T.

811. Calculation of wave forces on a sunken obstruction. J. E. Chappelear. *J. Petrol. Tech.*, 1957, **9** (8), AIMME Tech. Paper No. 4616, 227–30.—Using the linearized theory of waves (Airy theory) the forces produced by passing waves on a submerged object of infinite length have been calculated. The infinite length makes the problem 2-dimensional by eliminating diffraction, although the obstacle visualized was a drilling barge. Drag forces have not been included, and the assumption of infinite length is reasonable only so long as the length of the barge is large compared with the wavelength (actually this is not the case, so there must be appreciable diffraction effects).

The theory is outlined, and numerical methods for solution of the problem are given. Calculations are summarized for 1-ft waves of 6-sec and 10-sec period, acting on an obstruction 16 ft high and 80 ft wide in 40 ft of water. The results are compared with the conventional engineering approximation, the latter giving the smaller max force in both cases.

The computations are very tedious, and 16 significant figures are required. G. D. H.

812. Relationship between mud resistivity, mud filtrate resistivity, and mud cake resistivity of oil emulsion mud systems. N. Lamont. *J. Petrol. Tech.*, **9** (8), 51–2.—51 oil emulsion muds were prepared in the lab according to a standard manual. The diesel oil content ranged 5–50%, being near 10% in most cases. The aq muds converted were commercial clay and bentonite muds, high and low pH, lime, and caustic-quebracho treated muds. Various stabilizers were used. 23 field muds were also used. Standard tests were made for density, pH, visc, and filter loss. A Schlumberger EMT meter was used to obtain resistivities at 100° F. Filtrate and filter cake were obtained by a 30-minute Baroid filter press test.

The average relationship obtained was $R_{mf} = 0{\cdot}876\ R_m^{1{\cdot}075}$. Most of the data lay within limits satisfied by $R_{mf} = 0{\cdot}88\ R_m$. For the mud cake the comparable relationships were $R_{mc} = 1{\cdot}306\ R_m^{0{\cdot}88}$ and $R_{mc} = 1{\cdot}31\ R_m$. In the 2 cases the limits used were $\pm 25\%$. Thus average curves introduce considerable error, and there is no substitute for direct measurements of the various quantities. The sample tested should be representative of the mud opposite the formation logged.

Comparison of the average relationship for mud and filtrate with average published data for aq muds showed differences of 7–22%, but the curves had similar slopes. There were larger differences when the mud–mud cake relationships were similarly compared.

The filtrate from oil emulsion muds showed slight increase in resistivity as the oil content of the mud increased.

G. D. H.

813. Exploration for oil and gas. J. G. Spratt. *Engng J., Montreal*, 1957, **40**, 1249.—Petroleum products discussed include hydrocarbons ranging from asphalt to liq crudes and natural gas. These have been known for thousands of years, mostly from natural seepages. Since the first oil production —drilling as now known began *ca* 100 years ago—in Pennsylvania and Ontario at >100 ft depth, thousands of wells now are drilled annually from 5000 to >20,000 ft. Theories of oil origin, migration, and accumulation are presented. Growth of geological, geophysical, and geochemical methods is discussed. Exploratory drilling costs are extremely high. Acquisition of mineral rights is very complex in Canada.

R. T.

814. The concept of axial thrust in the turbo-drill. W. Ziraspolsky, R. Rouvière, and J. Charé. *Rev. Inst. franç. Pétrole*, 1957, **12** (6), 696–712.—The axial thrust is the axial resultant of the static and hydraulic forces acting on the rotor of a turbo-drill. It is important to distinguish this feature from the problem of the axial equilibrium of a drill-stem.

Examination of the interaction between rotor and stator of a turbo-drill shows that the turbo-drill has no specific influence on the equilibrium of the lower part of the drill-stem, but merely increases the pressure loss in the circulating fluid. The thrust depends on the pressure drop in the turbine and on the throughput.

Above the turbine the drill pipe behaves in the same way as with conventional rotary, in which the fluid flow and total pressure drop through the bit are the same as for the turbo-drill. It is, however, not necessarily the case that the techniques of straight and directional drilling are the same for the 2 types of drill. In the turbo-drill the drill pipe turns

only slowly or not at all, and the turbo-drill has 5 to 10 times the rate of rotation of a rotary bit.

The domain of the turbo-drill differs from that of the rotary drill, and thus involves different possibilities and problems. The former involves greater weight on the bit, which in itself increases the tendency to deviation. G. D. H.

815. Soviets emphasize new drilling practices. Anon. *Oil Forum*, 1957, **11**, 94–5.—In 1956 Russia produced 83 million tons of oil, *ca* 1,660,000 b.d., an increase of *ca* 18% over 1955. Soviet officials credit the turbo-drill for this. The turbo-drill's chief advantage is drilling rate. Rates are compared with those of other drills. The W. relies on refinement and perfection of working tools. The E. looks for robustness of machines and tools. In the Soviet oil industry radioactive substances are used on a mass scale for well coring and studying rock structures in wells. R. T.

816. More slant holes in Canada. A. G. G. de Chastelain. *Oil Gas J.*, 19.8.57, **55** (33), 225.—An increasing number of directional wells have been drilled in W. Canada, with the whipstock as the common deflecting tool. These wells have been analysed, and tables are presented which show, for various fields: (1) controlled footage; (2) deviation in ft; (3) max angle; (4) the results of surveys; (5) number of deflecting tools used; (6) comparison of times; (7) penetration rates; (8) costs; and (9) changes of drilling hook-up and average ft drilled per hook-up. C. A. F.

817. G.W.'s big rig flexes its muscles. E. McGhee. *Oil Gas J.*, 9.9.57, **55** (36), 93.—The equipment of a new diesel-electric rig, G.W. Rig 44, is described. It is to be used to drill a 22,000-ft well, 1-A Montgomery, which is planned to be the deepest in Texas. It is the largest rig in W. Texas, with drawworks motors rated at 2000 h.p. for hoisting, and total engine h.p. on the rig is over 3600 h.p. A diagram shows the layout of the equipment: 4 d.c. motors drive the drilling equipment, and these are interchangeable with one another. 3 generators, also interchangeable, provide the power for the motors. The engines are diesel, which is cheaper for remote wildcats. The operation of the equipment is noted and photographs are included. C. A. F.

818. Analysis of operation of drilling and coring bits of Polish manufacture. L. Szostak. *Nafta (Krakow)*, 1957, **13**, 156–8.—Comparing results obtained in 1954–56 on drilling efficiency and speed it appears that Polish bits do not stand up to the rigorous demands of their work. The averages are 10·6, 9·0, 9·83 m/bit in 1954–56 respectively for dia 216 mm and *ca* 60% more for dia 308 mm; and drilling speeds *ca* 1 m/hr $\pm$15% for all cases from the Glinek factory, whilst figures considerably lower are attained using bits from the Krakow factory. Summarizing, it appears that stricter inspection on receipt and general improvement of working standards is needed, as well as production of more types of bits which may be more suitable in specified circumstances than one standard type. M. S.

819. Retractable bit unveiled. Anon. *Oil Gas J.*, 30.9.57, **55** (39), 50.—Results of tests of retractable rock bits have been released. The bit is introduced on a wire line, engages the drill collar, and is then turned by drill casing. One type of bit has 4 cones and is designed to carry the collapsed cutters in pairs when making round trips. Details of the testing and equipment are given. 1142 ft were drilled with the bit using *ca* normal weights and rotation speeds, but drilling rate was only 65% and average footage only 55% of conventional methods. Use of a 3-cone bit was more successful and competitive with rotary bits, and it is estimated that savings of 25% of penetration costs in a 7500-ft section could be realized with this type. C. A. F.

820. New drill bit burns fuel oil. Anon. *Oil Gas J.*, 16.9.57, **55** (37), 109.—A new drilling technique known as jet piercing has been developed for blasting through spallable rock such as granite and quartzite. It has not yet been adapted to oil well drilling, but the method has been used to drill holes to 160 ft using heavy fuel oil or kerosine with oxygen and water. It is based on the rocket-jet principle, involving flame jets. C. A. F.

821. Technology of clay processing in projected works. J. Gumulczynski and S. Gierlaszynska. *Prace Instytutu Naftowego*, No. 48, Series A, 1957, 2–7.—So far, bentonite has been bought from Hungary, but in view of ever-increasing prospective demand for it Polish works will be established in Chmielnik. Local clay is quite useful without further treatment, and its treatment, such as required, is quite simple. It comes from Ciecierze, 2 km S. Estimate of deposit made suggests that there are 39·7 million tons of various grades of clay including less than 2% of sand and several veins of pure bentonite at a depth of 0·2–7 m. Investigations carried out were directed at improving the qualities of drilling fluids by suitable treatment of the mud and furthermore by appropriate additives and using correct pH. All that is summarized in tables, and a brief note on the method of treatment adopted. M. S.

822. Reclaiming barytes from drilling mud using hycrocyclone. H. Gorka and J. Gumulczynski. *Prace Instytutu Naftowego*, No. 48, Series A, 1957, 8–12.—Review of the operational principles of hydrocyclone and the application of this instrument at the Polish IP. The importance of the cheapness of these simple devices is stressed. M. S.

823. Future of aerated fluids in the drilling industry. B. P. Huddleston and W. D. Strange. *J. Petrol. Tech.*, 1957, **9** (8), 11–14.—Aerated drilling fluids represent an attempt to combine the advantages and avoid the limitations of conventional muds and air or gas for circulation.

Over 30% of producing companies' expenditure in the U.S.A. is on drilling and completion. Aerated drilling fluids might facilitate drilling in zones too wet to be drilled with gas, the loading with normal mud in emergencies, reduce sloughing because no conversion from a dry hole is needed, and give better cuttings. Penetration is better with lower hydrostatic pressures; these must include the circulating pressures needed to give adequate rates for removing cuttings. On test with low liq injection rates and high air rates a greater percentage of liq tends to flow along the pipe wall, reducing cutting–carrying capacity.

2 wells were compared in a field test. Over an interval of nearly 3000 ft the well with aerated mud used 12 bits; that with conventional mud used 38 bits. The former had the faster drilling rates.

Aeration may help in reducing lost circulation.

With aerated mud an inhibitor to check metal corrosion may be needed. Added expensive compressor capacity is needed. If water enters, changed air rates may be needed. Further study is needed, but the aerated muds may be advantageous under certain conditions. G. D. H.

824. In San Juan basin gas wells, liner completions make low-cost duals. E. McGhee. *Oil Gas J.*, 30.9.57, **55** (39), 77.—The method of completion of gas wells in the San Juan basin of the U.S.A. is described. In a typical well dual completion is carried out, the upper zone being the Pictured Cliffs sand and the lower the Mesaverde sand. The upper is cased off with 7⅝-inch o.d. pipe and the lower is cased off with a 5½-inch liner, thus making a saving in costs by running the liner below the intermediate string and below the upper zone, instead of carrying a full string of pipe.

Neither zone has high pressure, and this method of low-cost dual completion could be useful elsewhere.

A diagram shows the method of completion. C. A. F.

825. Drilling in water up to 1500 ft deep. Anon. *Oil Gas J.*, 7.10.57, **55** (40), 100.—Drilling operations from a floating barge offshore from California are described. The deepest well drilled from the barge was 6300 ft, and drilling has been carried out in water up to 1500 ft deep. Diagrams illustrate the method of drilling: flexible drill pipe and bit are first lowered through the barge well to the sea floor and a shallow hole is then jetted until hard rock is reached. A hexagonal base unit, surface casing, and ancillary equipment are then lowered by guide cables and the surface casing is cemented. The operation can be completed without the use of a diver. C. A. F.

826. Mobile drilling barge *Adma Enterprise*. Anon. *Gas Oil Pwr*, 1957, **52**, 237.—The displacement of this barge is *ca* 5800 tons, and it is equipped with spuds on which it can be raised above wave level. It can operate at water depths up to 80 ft. The drilling unit is powered by 4 12RPHM 400-h.p. Paxman engines and is completely self-contained as regards cement, drilling mud, etc. Electricity is obtained from 3 200-kW diesel-alternator sets each powered by a 12RPH Paxman engine.

The rig can drill a well up to 10,000 ft from a platform approx 40 ft above wave level. In the first instance it will be used in the Persian Gulf at a position *ca* 20 miles offshore. H. C. E.

827. Casing shoe eliminates plug drill-out. Anon. *Oil Gas J.*, 2.9.57, **55** (35), 160.—A recently developed casing shoe is briefly described in which the seats and plugs in the shoe are pumped out after cementing operations, leaving nothing to be drilled out. A packer is provided to give protection to formations below the shoe during cementation.

Diagrams illustrate the operation of the equipment; the casing is first run into position with the shoe open, circulating ports are closed, and an opening plug is then dropped to block the shoe opening. Applied pressure shears pins, setting the packer, and the cementing ports are opened. After the cement is pumped down a closing plug is introduced and further pressure is applied to the casing. This shears pins, permitting a sleeve, the seat, and plug to move downwards, closing the circulating ports. When the cement has set, pressure is again applied to the casing, and this shears a pin, releasing the seats and plugs. C. A. F.

828. Mechanization of loading and unloading drilling equipment and machinery. R. Wolwowicz. *Bull. Polish Inst. Petrol.*, 1957, **7**, 3 (Suppl. *Nafta* (*Krakow*), 1957, **13**).—3 phases of drilling are the preparatory, drilling proper, and dismantling. Drilling progress, to include all this, must be measured as $W_0 = \frac{M}{t_1 + t_2 + t_3}$ in m/month. The Mechanization Dept of the Polish IP has prepared a booklet which gives detailed instructions on procedure, aiming at the most efficient handling of portable equipment. There has been a considerable reduction in time taken up in completing preparations and dismantling. M. S.

829. Investigation into specific resistance of drilling core samples. Z. Jaszczewski. *Prace Instytutu Naftowego*, No. 47, Series A, 1956.—Investigations of specific resistance of cores are not common in Poland, and the work done by the author has been based on the first principles of the theory. Rock conducts mainly through electrolytic movement in the solution which permeates it. Thus all variations of conductivity are those of the electrolyte. The potential difference resulting from interaction of various solids and liq of perhaps various concn gives rise to osmotic potentials and junction voltages. Other voltages are created by diffusion potential and filtration potential. Polarization effects are also very important. In view of that, measurements may profitably be carried out with a.c. Author describes the method of preparation of samples, equipment used, and results, with several diagrams, photographs, and sketches. This has shown the nature of the problem and pointed to the shortcomings still to be overcome. M. S.

PRODUCTION

830. Reservoir volumetric parameters defined by capillary pressure studies. S. H. Lockwood, G. H. Lair, and B. J. Langford. *J. Petrol. Tech.*, 1957, **9** (9), AIMME Tech. Paper No. 4636, 252–9.—It has been found possible to define the capillary pressure curves reasonably by means of a small number of observations using mercury injection, and from these to draw a series of average curves for given mean porosities and carbonate rock types. The values obtained at high pressures show the interstitial water contents for samples a great distance above the water zone; those at low pressures are indicative of interstitial water contents near the water zone. The spread between these 2 is indicative of the oil-occupied space, with the form showing in a general way the distribution of pore sizes. As porosity decreases there is a rapid increase in interstitial water at a constant capillary pressure.

In fixing productive intervals cut-off permeabilities may not be especially helpful, and for carbonate rocks the interstitial water saturation–porosity relationship may be much more useful. The porosity giving a drastic change in pore-size distribution seems significant.

Dolomitization does not seem to have a unique relation to capillary pressure correlations. G. D. H.

831. Microhydraulics. Z. Wilk. *Nafta* (*Krakow*), 1957, **13**, 152–5.—Fluid flow through porous medium differs basically from flow through pipes. Defining the subject as unrelated to hydraulics, the author clears up some misunderstandings: Channels can be of various dia from monoatomic to visible cracks. The process includes filtration, which is separation of liq from solids suspended in them. Microhydraulics are involved in many other well-known phenomena of biology and physical chemistry, but in the case of flow of pure water through sand we are dealing with microflow only. This same phenomenon is taking place when water, oil, and gas flow through some medium without causing erosion. The subsequent suggestions clear several difficulties due to confusion over dimensions of various driving potentials, pressures, and forces. Whilst the main criticism is directed against the Russian work by Shchelkachev and Lapuk, the American publication by Jones is criticized, and in place of Reynolds No. the author suggests the use of $v_\mu = -\frac{k_\Phi dP}{\gamma dx} = \frac{Q}{\alpha \cdot F}$, where α = porosity, k_Φ = coeff of filtration, γ = density, and other symbols have their usual meaning. The whole problem really represents a new field of technology and its importance to the petroleum industry makes it imperative not to introduce errors of confusion into it. M. S.

832. Performance calculations for reservoirs with natural or artificial water drives. L. W. Wooddy and W. D. Moore. *J. Petrol. Tech.*, 1957, **9** (8), AIMME Tech. Paper No. 4613, 245–51.—The material balance–unsteady state equation permits the calculation of natural water influx corresponding to a given reservoir pressure–production history. In the case of artificial water drive or pattern water flood the material balance relationship alone is used. In both cases the reliable prediction of reservoir performance requires the calculation

of the reservoir fluid saturation distribution at different stages of depletion.

The relevant equations and their application are discussed for natural or artificial water drives and water-flooding. The methods are readily adapted for solution by means of a digital computer. The influence of gravity is considered, and it is shown that when this is important relative to viscous forces, the oil recovery will be higher the greater the dip of the beds (assuming low vertical permeability), the higher the reservoir permeability, and the lower the rate of water advance along the bedding planes. G. D. H.

833. An evaluation of the procedures used in the determination of grain densities of petroleum reservoir minerals. C. S. Brooks. *J. Petrol. Tech.*, 1957, **9** (8), AIMME Tech. Paper No. 4615, 235–44.—Grain density determinations have been made on several rocks or minerals by means of techniques using helium displacement, a modified low-pressure Boyle's law porosimeter, and liq displacement by water, *n*-decane, and *n*-octanol. Calcite, W. Texas limestone cores, Californian sandstone cores, and Wyoming bentonite were used, the number of samples used in each case being large enough to apply statistical methods. The calcite provided a basis for comparing the accuracy and precision of the techniques, for the substance was homogeneous and had minimum fluid–solid interaction. The liq displacement methods were most reliable and precise with the limestones, while gas-displacement procedures were best with bentonite and clayey sandstones.

A procedure is set out for evaluating the suitability of grain-density determination procedures for new formations, and a new form of Boyle's law porosimeter is described. This employs 2 equal chambers in a metal block, the chambers being connected to the 2 limbs of a manometer, and having micrometer devices for changing the free gas space in the chambers. G. D. H.

834. New technique for examination of oilfield brines. W. P. Aycock, E. W. Hough, and G. W. Crawford. *J. Petrol. Tech.*, 1957, **9** (8), 53–6.—40 oilfield brines have been examined by a polarographic technique known as tensammetry. In this a weak a.c. voltage is superimposed on a d.c. voltage applied to a dropping mercury electrode in contact with an electrolyte containing a small amount of surfactant. The resulting a.c. is measured to provide the experimental data. The response curves showing percentage a.c. current against the d.c. current across the cell are characteristic of the brines. The response curves for waters from different fields in the same formation were similar, but different from brines from other formations. The response curves for water from the Bradford field 3rd Bradford sand and the Oklahoma City Wilcox sand, both thought to be in oil-wet sands, were similar, and markedly like that of E. Texas, for which some observations suggest at least partial oil-wetting of the oil sand. G. D. H.

835. Log correlation in heterogeneous carbonate reservoirs. R. H. Winn. *J. Petrol. Tech.*, 1957, **9** (9), AIMME Tech. Paper No. 4637, 268–74.—In simulated wells relationships between porosity and neutron–γ counting rate have been obtained for the logging tool when centred and when adjacent to the walls for uncased, water-filled holes of various sizes. The tool is thought normally to be at the wall, and so the proper relationship can be used for surveys in uncased holes. However, when there is a thick mud cake, or casing (possibly eccentric), or irregular holes, the porosity determination is less reliable. Caliper surveys may help. Tests show that even at zero speed porosities cannot be resolved if the interval is under 16 inches thick. Max logging speeds of 20 ft/min are recommended.

A radiation survey has been correlated with whole-core analysis, and a relationship between porosity and counting rate derived for weighted core-analysis data over 3-ft intervals, on the basis of 1 : 2 : 1 averaging for the 3 separate feet. Summaries of the data for 2923 ft of hole ranging $4\frac{3}{4}$–10 inches dia did show good agreement between measured and neutron-γ porosity for the Permian and Ordovician–Pennsylvanian rocks, but excluding the Devonian. A nomogram is given for relating counts, porosity, and hole size.

The water saturation can be obtained from the resistivity log (forcused device) and the porosity via Archie's formula, when $R_{mf}/R_w \leqslant 1$, and the bed is homogeneous for 2–3 ft. To avoid the use of departure curves the expression

$$R_a = d'[0{\cdot}633\ (\log D_i/d)R_{xo} + (1{-}0{\cdot}633)\ (\log D_i/d)R_i]$$

where d' ranges from 1 in a $3\frac{5}{8}$-inch hole to 0·8 in a 9-inch hole, and $D_i/d \leqslant 5$ and $R_{mf}/R_w \leqslant 10$ is suggested.

A chart relates neutron-γ counts (porosity), apparent guard resistivity, and water saturation for various cementation exponents.

Examples of the radiation–guard log analyses for several limestone formations are given, and relationships between porosity and interstitial water content are shown for different rock types. G. D. H.

836. Stability requirements for scintillation counters used in radioactivity logging. A. Youmans and R. Monaghan. *J. Petrol. Tech.*, 1957, **9** (8), AIMME Tech. Paper No. 4614, 231–4.—In good scintillation counter logging the sensitivity should be as nearly constant as possible, otherwise the advantages over other types of detector are lost, and quantitative interpretation is of doubtful value. In many scintillation counters designed for well logging a pulse height variation of 1% gives *ca* 1% variation in counter rate. This requires under 0·1% change in the voltage applied to the photomultiplier tube with 10-stage multiplication. The design should make temp-induced effects compensating in the electronic circuits.

Since slight stray magnetic fields affect the gain of the photomultiplier tube, adequate magnetic shielding is needed. Present commercial photomultiplier tubes are permanently damaged by temp above 150°–175° F, and tube characteristics may vary below this range. For NaI of the type usually available, the efficiency may have a temp coeff of $-0{\cdot}12\%/^\circ$ C, while the gain of the photomultiplier tube may change by $0{\cdot}2\%/^\circ$ C to $0{\cdot}5\%/^\circ$ C. Variations in detector temp have been kept small by enclosing the scintillation crystal and photomultiplier tube in a dewar flask. By this means successful runs have been made in holes with bottom-hole temp as high as 300° F.

Other troubles arise from detector activation and photomultiplier fatigue. In the former case compromise is necessary between high counting rate and high statistical accuracy, and freedom from drift due to iodine activation. G. D. H.

837. Reconnaissance and evaluation of formations by electrical and nuclear diagraphy. L. G. Chombart. *Rev. Inst. franç. Pétrole*, 1957, **12** (5), 543–64.—The first step in the analysis or interpretation of a log is to assess its quality and the quality of the aux data. Possible causes of defective quality are listed. Sometimes the defects are revealed only in the course of interpretation. The various types of log must be properly correlated with respect to their depth indications, and then the main lithological units should be marked off before dealing with quantitative studies of the units of special interest.

The logging programme must be designed to get necessary and sufficient data, note being taken of whether the well is a wildcat or for development. A table supplementing the discussion gives the data required, the techniques available for this purpose, and the means of getting the data from the logs or other observations. G. D. H.

838. Pressure maintenance with warm-water injection. J. Wahl. *Oil Gas J.*, 26.8.57, **55** (34), 114.—Between 250,000 and 275,000 acres are commercially productive in the Pembina

field in Alberta and of these *ca* 150,000–175,000 acres can be produced under pressure maintenance by water injection. The remaining area is suitable for gas injection. At present water injection is being carried out on a 160-acre, 5-spot pattern over limited areas. The water is heated to 120° F before injection, and results so far show that the gas–oil ratio will become stabilized with injection of 15,000–20,000 brl/well and thereafter will decrease rapidly. It is predicted that the use of warm water will recover 5% more oil than cold water.

The reservoir characteristics of the Cardium pay are described, together with details of the predicted performance and injection programme. Ultimate recovery under pressure maintenance (with warm water) is estimated at 107,034,000 brl.

C. A. F.

839. Orco pins hopes on carbonated flood. Anon. *Oil Gas J.*, 2.9.57, **55** (35), 88.—After lab and pilot tests, carbonated water is to be used for flooding a stripper area NE. of Bartlesville, Oklahoma. It is believed that it will recover twice as much oil/acre as gas-free water, which is used in other floods in the area. It is suggested that CO_2 in the water acts as a wetting agent throughout the pay, has a miscible-phase effect on the pay, and increases rate of water injection.

The pay sand occurs at 1300 ft, and the flood will be carried out on a 5-spot pattern with water from the Arbuckle at 2500 ft. The CO_2 will be generated on the lease. C. A. F.

840. Big profits from water-flooding operations. W. H. Davison. *Oil Forum*, 1957, **11**, 120–2.—3 main sources of domestic oil production are available to meet U.S. requirements of >11 million brl, 20% > present consumption. These are coastal deposits on the continental shelf, wildcatting of sedimentary basins, and application of water flooding to depleted oilfields. Statistics show the enormous expense and uncertainty of wildcat drilling. Offshore drilling is beyond the means of a small company with limited capital. The capital required for take-over for water flooding methods for secondary oil recovery is relatively small. The same—or even greater—production may be expected from secondary as from primary recovery. A field under water flood is not subject to proration. The great success of Tekoil Corpn—engaged in secondary recovery by water flooding—supports the case for this procedure. It is estimated that floods can be expected to account for >32,500 million of crude oil from domestic fields. R. T.

841. How rock and fluid properties affect flow in the reservoir. F. E. Merliss, J. D. Doane, and M. J. Rzasa. *Oil Gas J.*, 2.9.57, **55** (35), 153.—Factors affecting 2-phase permeability are discussed as a result of lab experimental work in which external drive, solution-gas drive, and steady state flow were simulated. The results show that there is no simple relationship between the bulk physical properties of the porous medium and permeability to immiscible fluids which are flowing simultaneously inside the medium. Among other conclusions it was found that permeabilities in 2-phase flow are not single-value functions of fluid saturations for a particular porous medium, but depend on the fluid distribution within the medium. The results of the work indicate that 2-phase permeability requires further study. 12 refs.

C. A. F.

842. World production: an eventful year. Anon. *Petrol. Press Serv.*, 1958, **25** (1), 1–5.—Free World crude oil production in 1957 was *ca* 768 million metric tons, a record, 29 million tons > in 1956 made up of −10 million tons in Iraq and +39 million tons elsewhere. Since the Suez crisis—with its sharp temporary check to growth of consumption in Europe—normal production level has been re-established everywhere excepting in Iraq. Residuary effects of the crisis, combined with a slowing-down in economic activity in the U.S.A. and, to some extent in W. Europe, and checks on U.S. imports have retarded expansion tempo in late summer and autumn. Comparison with 1956 may be misleading, due to stocking-up against eventualities connected with the Suez Canal dispute. In spring 1956 U.S. output—to make good deficiency in Persian Gulf supplies—was a record. Later cut-backs in production brought the year's total to the preceding year's level. In Venezuela production advanced rapidly to meet the Suez crisis, slowed down later, and rose again to a new high figure for the year. Output in the U.S.S.R.—exceeded only by Venezuela—advanced rapidly to 14 million tons > in 1956. Projected production by 1972 is ≮350–400 million tons p.a. World production in 1957 reached 881 million tons. Production in Persia, Kuwait, and Indonesia increased also. Increases in production are reported in Colombia, Trinidad, Argentina, and Brazil.

R. T.

843. Adena goes to up-dip water injection. J. O. Scott. *Oil Gas J.*, 23.9.57, **55** (38), 121.—The Adena field in the Denver–Julesburg basin of Colorado is being water flooded by injecting water up-dip from the oil in order to sweep the oil down-dip to producing wells. Pay is the J sand, which dips gently W. and pinches out up-dip. Gas overlies the oil, which in turn overlies water and the up-dip method of injection has been introduced because injection into the water zone down-dip would cause oil to be lost up-dip into the gas cap.

Reservoir studies showed that natural water drive was negligible and that the primary mechanism was gas-cap and solution-gas drive. Estimated primary recovery was *ca* 30% of original oil in place, and it is thought that this will be increased to 50% by the injection project. Details of reservoir characteristics are given, and it is estimated that the displacement efficiency of the flood should be *ca* 65%.

Initial injection rates should reach 50,000 b.d., with an average of 35,000 b.d. during the flood period. The complete flood will require *ca* 10 years, and it is estimated that this will recover *ca* 71 million brl. Source of water is shallow gravel, and it will be treated by filtration and addition of reagents.

C. A. F.

844. Canadian gas wells respond to fracture treatments. W. M. Thorvaldson. *Oil Gas J.*, 19.8.57, **55** (33), 175.—The use of gelled water as a fracturing fluid has had successful results in Canada; treatments have been mainly on gas wells. Gelled acids and diesel oil have also been used successfully, but they are expensive and there is a fire risk. Suitable additives are available to control emulsions and silicate swelling. In many areas the determining factor in the choice of method is relative cost.

Details of the gelled water treatment are given, and tables show the comparative costs of different fracturing fluids and details of production before and after gelled water and gelled oil treatments. C. A. F.

845. How Egypt is faring. Anon. *Petrol. Press Serv.*, 1958, **25** (1), 11–13.—The Suez Canal episode has resolved itself, but its consequences lie beyond assessment. Negotiations for a settlement are still inconclusive. By strict import limitation Egypt appears to have held her balance of payments position. The switch of overseas trade—chiefly with the U.S.S.R.—is virtually to a barter basis, and her earnings from imports—of closely restricted range—are slender. As regards her indigenous supply of crude oil Egypt's position has improved in the past year. Imports of products at present come wholly from the U.S.S.R. and Rumania, but Egypt now has increasing supplies of indigenous crude. This is due to rising output from the Belayim field, discovered in 1955, and Abu Rudeis, discovered in 1957. The Egyptian state, the Italian AGIP, Petrofina, and others have an interest. The crude is of low quality, containing much salt and sulphur.

The country's oil production—including that from fields belonging to Anglo-Egyptian Oilfields and Mobil of Egypt, all being operated by the Egyptian sequestration authorities—is estimated at *ca* 2·5 million tons/year. Some oil has been exported to Italy, but substantial imports of products—now coming from E. Europe—are necessary. The Egyptian Government is participating in oil exploration through the state-owned General Petroleum Co., which has been granted 63 exploration licences in the Gulf of Suez area. Despite Soviet and Czechoslovakian loans, the Egyptian Finance Minister intimates that foreign loans free from political conditions would be welcome. R. T.

846. First attempts to employ radioactive isotopes in Polish petroleum industry. Z. Zakrocki. *Nafta* (*Krakow*), 1957, **13**, 162–3.—The Polish IP started preparations in 1954, and in Oct. 1956 a conference decided that the first use of radio-isotopes could be made in tracing flooding arrangements. In March 1957 radioactive $ZnCl_2$ was introduced at Turaszowka. M. S.

847. Foreign review—deepest well in Europe. R. Piatkiewicz. *Nafta* (*Krakow*), 1957, **13**, 171.—One of the brief notes in the review describes the procedure adopted in drilling a well to 4812 m at Ziria, near Baku, which produces 50–60 tons daily (according to *Nyeftianik*). Bulgaria produces 25,000 tons/month, and 20% of it is exported. M. S.

OILFIELD DEVELOPMENT

848. Citronelle: ailing at an early age. J. Reilly. *Oil Gas J.*, 19.8.57, **55** (33), 93.—The Citronelle field, discovered in Alabama in 1955, has not developed production as expected, although proved reserves are estimated at *ca* 150 million brl. Pays are Rodessa sands, but these proved to be tight, and production has declined as bottom hole pressure decreased with development drilling. It has been estimated that b.h.p. in an average well has fallen by *ca* 1 lb/50 brl produced. Original b.h.p. was *ca* 5000 p.s.i., and this has now declined to *ca* 2700 p.s.i.

Drilling costs in the field are high, as pays are deep (below 10,000 ft), and most wells require pumping on completion. Acidizing and fracturing have been used to stimulate production, but results are as yet inconclusive. C. A. F.

849. Wilson Creek field, Rio Blanco County, Colorado. J. B. Ladd. *J. Petrol. Tech.*, 1957, **9** (8), 23–7.—The Wilson Creek field was discovered in 1938. Production is from the Morrison and Sundance on a pear-shaped dome. The Morrison production is from thin to massive lenticular fine sandstones, with fractures, and siliceous, calcareous, and argillaceous cement. The intergranular permeability averages only *ca* 11 mD, while porosity ranges 10–23%, and the interstitial water averages 39%. The 50° API crude is produced partly by liq expansion, partly by water drive, and partly by dissolved gas, the original pressure being 2180 p.s.i.g. and the bubble point 1100 p.s.i.g. The pay thickness ranges 21–98 ft.

The Sundance is uniform, massive, and *ca* 420 ft thick. Cross-bedding is common: the porosity is 14–27%, horizontal permeability 39 mD, and interstitial water 33%. The water table is warped and tilted, and there is a vigorous water drive. The original pressure was 2202 p.s.i.g., and the bubble point 240 p.s.i.g.

The Morrison now gives 4800 b.d. from 21 wells. At the beginning of 1957 the cumulative output was 20,580,000 brl oil, 166,000 brl water, and 10,387,465,000 cu. ft. of gas. The Sundance now gives 2400 b.d. oil and 8900 b.d. water from 17 pumping wells. At the beginning of 1957 the cumulative output was 14,231,000 brl oil, 15,050,000 brl water, and 1,346,958,000 cu. ft. gas. The current reservoir pressure is 1825 p.s.i.g. Water is advancing parallel to the bedding planes and tight streaks. There are conventional beam pumps as well as sub-surface electrical centrifugal pumps. A 150-h.p. unit set at 4500 ft is giving 3200 b.d. of fluid. Gas lift is to be expanded. Drilling and completion is expensive; roads and locations are difficult.

Gas injection into the top of the Morrison began in 1946, and has averaged 10^6 cu. ft/day; recently the rate was raised to $2{\cdot}3 \times 10^6$ cu. ft/day. There are only a few cases of serious channelling. Downflank gas injection has begun in the Sundance, to reduce visc by solution, and to give a greater amount of gas in the pores on depletion, thereby reducing the residual oil content. The field is completely electrified, with automatic control where possible. An 18-mile pipeline can take 7500 b.d. by gravity flow alone. Wax deposition is a problem, especially in winter, in pipes and wells. Water is disposed of by injection (8000 b.d. at 350 p.s.i.g.) into the Mancos shale fracture system. G. D. H.

850. These charts can help you analyse oil-prospect costs. L. F. Ivanhoe. *Oil Gas J.*, 23.9.57, **55** (38), 172.—A series of simple graphs are presented which can be used to make a rapid qualitative evaluation of costs involved in the preliminary appraisal of the development of an oil prospect. The charts show: (1) average costs of oil well drilling in the San Joaquin Valley, California; (2) well pay-outs, the brl oil required to pay out or regain a given investment; (3) basic operating costs, the minimum production required to operate a lease profitably (in the San Joaquin Valley); and (4) a universal chart which shows the total ultimate production from a well at any given decline rate. Examples of the uses of the charts are given. C. A. F.

851. Where prospecting has a deadline. E. G. Haines. *Oil Gas J.*, 19.8.57, **55** (33), 290.—Oilfield operations in the Upper Hay River area of N. Alberta are outlined. Drilling conditions are severe, and most exploratory work must be carried out during the winter months, Dec. to March, when the muskeg is frozen. One of the biggest problems is the lack of adequate communications, but these are improving with the introduction of microwave equipment. Working conditions are arduous because of the rough terrain and sub-zero temp.

Problems of drilling and seismic work in this area are noted. C. A. F.

852. 5 trillion cu. ft. gas ready for West Coast. C. R. Hetherington. *Oil Gas J.*, 19.8.57, **55** (33), 127.—Oil and gas fields in the Peace River area of Alberta and British Columbia are to be served shortly by a network of gathering and transmission lines which will carry gas to Vancouver and NW. U.S.A.

The search for gas in the area in order to support a big-inch pipeline has resulted in the finding of a total reserve of over 5 trillion cu. ft. One of the most important fields is Fort St John, where gas occurs in several zones in a large structure.

The gas varies widely in composition over the area, and the reservoir rocks are Lower Cretaceous and Trias sands and Permo-Pennsylvanian and Devonian carbonates. The accumulations in the Cretaceous Cadomin sand have inclined gas–water levels, so that the productive areas tend to lie on the flanks of structures.

A wide range of completion techniques is used, and these are outlined. Shooting and fracturing techniques have been used with equal success, and high pressure acidizing treatments have been used in dolomite zones.

The wet sour gas from the area will be processed in a gas scrubbing plant now under construction in British Columbia, and a refinery is also being built near by. C. A. F.

853. Widening quest in Central America. Anon. *Petrol. Press Serv.*, 1957, **24**, 447–8.—Active exploration is proceeding

in every republic of Central America excepting Salvador, which has no sedimentary deposits, and in British Honduras. Costa Rica, Honduras, and Nicaragua are preparing new oil laws. Guatemala, whose new oil laws came into force in 1955, is experiencing an exploration boom (see *Petrol. Press Serv.*, Jan. 1956, p. 25). Central America as a region—apart from the more liberal attitude towards foreign capital investment—with Caribbean and Pacific coastlines and proximity to the U.S.A., has benefited from the current drive to find oil in the W. Hemisphere. Taxation concessions in the U.S.A. for companies exploring in Central America has attracted many U.S. independents. In Guatemala almost all the known sedimentary areas are covered now by concessions held by a large number of companies. Considerable preliminary exploration work—seismic survey, core drilling, and aerial survey—has been carried out. Exploration in British Honduras is being intensified by Gulf and Royal Dutch/Shell under an agreement whereby the latter acquire a 50% interest in 4·5 million acres in the N., including offshore areas. Companies with large U.S. participation are exploring in Honduras. In Nicaragua an 11 million-acre concession along the Caribbean coast is being explored by 3 U.S. companies. A well planned to go to 13,500 ft is being drilled in shallow water 25 miles off Puerto Cabezas. In Costa Rica a well is being drilled 24 miles NW of Limon. Panama is covered completely by concessions; Cataract Mining Corpn, with 5 million acres, is the largest holder. In spite of the present exploration wave, oil potentialities of Central America still have to be proved. R. T.

854. Jordan drilling deal is made. Anon. *Oil Gas J.*, 16.9.57, **55** (37), 120.—A second exploration concession has recently been granted in Jordan, and the operating company plan an initial surface geological survey followed by airborne magnetometer and seismic surveys. In the first concession a well is being drilled in the Mashash area *ca* 30 miles E. of Amman. C. A. F.

855. Vigorous search for oil in Pakistan continues. S. A. Kidwai. *Oil Forum*, 1957, **11**, 85–6.—5 different oil companies, participating on a 50/50 basis with the Government, are exploring for oil in Pakistan. Indigenous oil production conc in the Potwar oilfields near Rawalpindi supplies *ca* ¼ of the country's total petroleum requirements. Natural gas exists in vast quantities at Sui in W. Pakistan and at Sylhet in E. Pakistan. Combined natural gas resources of Sui and Sylhet—sixth largest in the world—are capable of supplying all the industries established in the country. Natural gas production from Sui field is approx equiv to 4 million gal of fuel oil, which would have to be bought abroad. Oil output from the Potwar fields amounted to 72,360,000 gal (all products) in 1955, which is far short of the country's needs. The increased pace of oil prospecting is due to the hope that natural gas occurrence may be a clue to petroleum's presence. R. T.

856. Big plans loom for oil sands. Anon. *Oil Gas J.*, 19.8.57, **55** (33), 120.—A pilot operation for mining oil sands in the Kirmak Mountain area near Baku, Russia, is reported to have had successful results, and full-scale development is planned involving a large industrial plant to mine and process the sands. The area has supplied oil locally for many years. Saturated sands with a yield of *ca* 30 gal/cu. yd. outcrop at the surface. C. A. F.

TRANSPORT AND STORAGE

857. Oil—No. 1 transportation job. H. N. Emerson. *Oil Gas J.*, 18.11.57, **55** (46), 226.—Various forms of transportation are listed, and factors underlying preferences for any one form are discussed. G. A. C.

858. Transportation of oil. E. C. Hurd. *Engng J., Montreal*, 1957, **40**, 1259.—Gradual growth of all forms of oil transport—highway, rail, pipeline, and tanker—is traced. Dependence of world economy on continuous oil tanker movement was emphasized by events leading up to and following the Suez crisis. Tanker capacity has increased from 125,000 to 600,000 brl. Charter rates are extremely sensitive to the law of supply and demand. The vast network of main and gathering lines from E. to W. Canada, including the 1774-mile line from Redwater to Sarnia—the world's longest—is described. *Ca* 1000 miles of loops of various sizes connect new oilfields and refineries. The 1957 programme calls for additional looping in 16-, 18-, and 26-inch lines connecting up vast areas. Throughput in 1956 averaged 266,000 b.d. for a total of *ca* 97 million brl. Trans-Mountain pipeline in operation in late 1953, with a 24-inch line from Edmonton to Burnaby, near Vancouver—with initial capacity 75,000 b.d., increased later to 120,000 b.d.—afforded the first outlet for Canadian crude to the W. coast. Operation of this line is discussed. To pass from 200,000 b.d. capacity to 300,000 by pumping station addition would require 7 more stations. If capacities >300,000 b.d. are foreseen, weighing the higher capital cost of looping against the higher operating costs of the numerous stations indicates preference for the former. Canada has reached virtually the self-sufficiency pt as regards refining capacity, and may become a net exporter in the near future. R. T.

859. Transporting and marketing natural gas. B. F. Willson. *Engng J., Montreal*, 1957, **40**, 1270–2.—The gas supply is followed from the transmission system inlet, through the distribution systems, to the delivery pt to customers' premises. Economic feasibility studies necessary in considering a pipeline project; engineering aspects, economic and cost features are dealt with. Estimates of market potential must be prepared; market growth forecasts are required; competitive fuel costs must be investigated. Assured long-term supply is essential for the financing of any major project. Trans-Canada Pipe Lines over the 2200-mile length cost $350 million. Purchase contracts with producers are essential. Preliminary engineering studies of the terrain, pipeline design, compressor station spacing, operating pressures, etc., are required. Finally, projections of estimated costs and revenues can be compiled. R. T.

860. VHF controls Sarawak sea loading operations. Anon. *Pipe Line Ind.*, 1957, **6** (4), 44.—Portable VHF units on board the tankers, 3·5 miles offshore, have each a coded pump control signal. In case of emergency, burst delivery line, or other hazard, tankers can shut down the pumps immediately. R. T.

861. Tanker-building boom. J. J. Winterbottom. *Oil Gas J.*, 30.12.57, **55** (52), 196.—Tables show world tanker positions, constructions, and classification by flag as of 1 Oct. 1957. Tonnage now on order is 40 million dwt, as reaction to Suez closure. G. A. C.

862. Old crude lines get a cleaning for field products service. J. F. Stephenson, H. E. Waldrip, and H. B. Green. *Oil Gas J.*, 25.11.57, **55** (47), 82.—A new chemical process for cleaning a 474-mile crude oil pipeline for field product service involves a detergent in alkaline soln, followed by water flush, descaler consisting of hydrochloric acid containing a wetting agent,

water flush, descaler, water flush, and finally, neutralizing soln. G. A. C.

863. Automation scores in double jointing. P. Reed. *Oil Gas J.*, 16.12.57, **55** (50), 82.—A new unit used in handling, rotating, and welding of pipeline during double-jointing operations has production rate on 30-inch dia pipe of 10–12 welds/hr. G. A. C.

864. Unattended pumping station. Anon. *Gas Oil Pwr*, 1957, **52**, 267–9.—This, the first automatic pumping station for handling petroleum products, is on a 10-inch pipeline between Eldorado and Kansas City. Following a general account of the layout, the method of starting and stopping the 800-b.h.p. diesel engine from Eldorado, 100 miles away, is described. The engine is cranked by a compressed air motor, and if after 5 successive attempts the engine fails to fire, a signal is sent to the control station. Safety devices which automatically stop the engine can detect high jacket-water temp, low jacket-water level, low lub oil pressure, high gear- or pump-bearings temp, etc. Load balance between cyl can be compared from Eldorado by means of thermocouples indicating the exhaust temp of each cyl. H. C. E.

865. Shellhaven–Romford refinery gas pipeline. A. D. L. Copp. *Fluid Handl.*, 1957, 361–6, 370.—Extracts from paper presented to Inst. Gas Eng. Building of the 15½-mile Shellhaven–Romford 24-inch refinery gas line by North Thames Gas Board is described, including planning, acquisition of right-of-way, construction materials, equipment and procedure, coating, testing, pigging, and cathodic protection. Max working pressure is 275 p.s.i.g., and at outlet pressure of 70 p.s.i.g. transmission capacity is $10{\cdot}8 \times 10^6$ cu. ft/hr. W. A. M.

866. The Trans-Iranian pipeline. Anon. *Pipes & Pipelines*, 1957, **1** (8), 16.—The 700-mile pipeline—construction and operation described with supporting maps—will convey *ca* 1 million tons/year of petroleum products from Abadan to Teheran. Costain-John Brown, with American associates Williams Brothers Ltd, have constructed approx 300 miles from Ahwaz to Azna. The work—in spite of difficult terrain—was completed 4 months inside schedule at a speed of 1·5–3 miles/day. The Zagros mountains and waterways presented the most difficult obstacles. The line from Azna to Teheran is being laid by a French company. At present only 6 pumping stations are required. Supercharged diesel engines, each with max running speed 500 rev/min, and output 540 h.p., drive the pumps. 3 pumping units, to deliver >700 gal product/min at 1000 p.s.i. are installed in each pump house. Later, 13 stations will increase throughput to 2 million tons/year. Max automatic operation of the pipeline is ensured. Besides 28,000 tons of high-tensile steel pipes (42,000 lengths), more than 10,000 tons of cement and other materials were required in Persia before work on the pipeline proper—dependent on design completion in London—began. The pipes are protected with special coatings. Excellent social and health services have contributed to the high rate of progress. R. T.

867. Long-distance gas transport in the U.S.A. Anon. *Pipes & Pipelines*, 1957, **1** (7); **1** (8), 21–4.—Pt 1. Information presented emanates from the visit of a fact-finding mission to S. France, Italy, and the U.S.A. A report (Project 118) of an OEEC and MSA sponsored Tech Assistance Mission to study long-term distance gas transport networks in the U.S. practice has been issued. In 1953 U.S. transport network developed length was *ca* 128,000 miles, covering nearly all the states; the rest will probably be connected shortly to Canadian networks. In the U.S.A. 88% of the enormous liq and gaseous hydrocarbon reserves exist in the W., the main industrial areas in the E. Up to 1940 transport techniques were suitable only for natural gas on a regional scale. During world war II oil was transported from W. to E. Post-war fuel gas demand resulted in new transport networks, and natural gas established itself as the cheapest energy source. Transformation of plant was performed, using the ample post-war cash reserves. In 1953 natural gas accounted for 94% of all cal consumed, and for 23·1% of total U.S. power consumption. Underground storage facilities ensure that ⩽95% of max annual transport capacity is used. Whereas *ca* 66% of power used in the U.S.A. is provided by oil products and natural gas, the European figures are reversed. Almost all oil products are from abroad, and natural gas—chiefly from the Po Valley in Italy and Lacq in France—provides only a small fraction of power requirements. Prospecting proceeds in Europe and the Sahara. Increase in European gas consumption will call for new coal carbonization, and solid and liq fuel gasification techniques. Conditions in the U.S.A. and Europe are compared. Importing natural and residual gas in the liq state into Europe from overseas is discussed.

Pt 2. A tech and economic study of pipeline schemes is presented. The Panhandle formula presented seems to have supplanted the Chicago and Weymouth formulæ. In the Panhandle formula a factor E (pipeline flow efficiency)—convenient for checking the int condition of a pipeline in use—has been introduced. The Panhandle formula is suited particularly to long-distance natural gas transport, the main feature of which is a large-dia piping and a gas flow corresponding to comparatively high Reynolds No. (4–40 million or more). The Weymouth formula is applied often to lower Reynolds No. The method of determining the most economic factors for long-distance transport of natural gas is presented. Details contributing to the cost—compressor stations, financial charges, taxation, etc.—are analysed and explained. R. T.

868. Why Transcontinental likes cool microwave stations. Anon. *Pipe Line Ind.*, 1957, **6** (4), 36–7.—Results from conditioning units installed at 40 of the hottest, dustiest Transcontinental Gas Pipe Line microwave stations are impressive. Longer tube life, improved transmitter stability, and high circuit availability result. R. T.

869. 1000 miles of microwave tested from desk console. M. A. Judah. *Pipe Line Ind.*, 1957, **6** (4), 38–40.—To save time and needless effort in making routine checks, all test circuitry is duplicated in a multiplex test console fitted on a standard 5-ft desk. This console comprises a complete monitor of Platte Co.'s 45-station microwave system from Central Wyoming to Wood River, Illinois. R. T.

870. "Snooper" controls compressor surges. F. V. Long. *Pipe Line Ind.*, 1957, **6** (4), 41–3.—An electronic device developed by Texas Eastern engineers—illustrated and described—senses a surge condition—a dangerous operating hazard in centrifugal compressor stations—particularly if unattended. Corrective action then is taken by means of a pre-set feedback control system. R. T.

871. Pipeline crosses the Rio Grande on dry ground. R. C. Hughes, Jr. *Pipe Line Ind.*, 1957, **6** (4), 49–53.—Texas Eastern Transmission Corpn's new 422-mile main 30-inch line includes 22 miles of bay or river water crossings. The completed line—construction described and illustrated—will connect Texas Eastern's 5700-mile pipeline network with a line under construction by Petroleos Mexicanos to the international border. For the first time Mexican gas will be conveyed commercially into the U.S.A. R. T.

872. Aramco whips sabkhahs on Ras Tanura line. H. T. Brundage. *Pipe Line Ind.*, 1957, **6** (4), 60–2.—Arabian

American Oil Co. rushes its 22-inch crude oil pipeline from Safaniya oilfield to the Ras Tanura refinery. How supply difficulties brought on by the Suez crisis and unusually tough terrain were overcome is described. Part of the line is submarine, but 28 miles of the 22-inch line will be supported on piling across the Arabian sabkahs or salt flats. R. T.

873. Hydraulic surge in airfield hydrant systems. Anon. *Fluid Handl.*, 1957, 322–6, 367–70.—Operation of aircraft shut-off valves causes shock pressures in refuelling hydrant systems. B.P. Trading Ltd have investigated the problem and issued a lengthy report, extracts from which are given. Test rig is described and illustrated, and results of tests are tabulated. Fitting alleviators gave some reduction in shock pressure; optimum precharge pressure and siting were established; formula is given for calculating alleviator size required. Surge pressure may also be reduced by restricting fluid velocity change, *i.e.* increasing line size, or by changes in design of shut-off valves. Valves tested showed a tendency for almost all the closure to take place in last 30% of closing period. It is suggested that max allowable pressure in British civil airworthiness requirements is too close to normal working pressure, thus giving insufficient margin for surge. W. A. M.

874. Fuel oil distribution in the Midlands. Anon. *Fluid Handl.*, 1957, 356–8.—Illustrated description of Charrington's new bulk storage terminal for fuel oil at Bedworth. Present capacity is 2×10^5 gal, with provision for considerable expansion. W. A. M.

875. Is underground storage competitive? Anon. *Petrol. Refin.*, 1957, **36** (10), 160–1.—Several results of a survey made by the National Petroleum Council are presented which show the competitive position of underground storage *v.* above-ground storage. The factors affecting the economics of underground storage are outlined and include type of product to be stored, geology of formation above storage formation, size of storage, method of product removal, operational rates required, and storage costs. The survey shows that underground storage is more economical only when large quantities are to be stored. J. R. T.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

876. Petroleum refining. C. W. Coote. *Engng J., Montreal*, 1957, **40**, 1273.—Requirements, location, personnel, materials, equipment, etc., are given for a mainly automatic refinery. A round figure of plant investment cost is $1000/brl of daily throughput for a 25,000-b.s.d. plant. The cost may be doubled for a small complete plant, less for a larger unit. In this article an explanatory tour is made of an integrated refinery showing where a more complete one would draw raw materials from for product or speciality production. The octane race is mentioned. O.N. 107 for premium gasoline in the U.S.A. is forecast, and for household brand O.N. 98 in 1965. Average C.R. will be 12:1 by 1961, and refiners' costs will be *ca* 60 c/brl more to manufacture products. O.N. improvement by T.E.L. is limited to 3·6 c.c/I.G. for safety reasons. The petroleum product market will grow rapidly. Competitive conditions will impose plant automation. Changing market conditions and gradual lessening of the bunker fuel market will result in installation of processing equipment to produce more white products and less residual. More light gases produced will have to be processed into stable fuel. Crude quality will decrease, necessitating alloy steels for corrosion resistance. The Sasol plant in S. Africa is quoted to allay worries about the future of oil. R. T.

877. Refining highlights. Anon. *Oil Gas J.*, 30.12.57, **55** (52), 151.—Countries in 5 principal oil-producing areas are listed with report on refining in each country, which includes Latin America, W. Europe, Middle East, Asia, Australia, and S. Africa. G. A. C.

878. Solid gilsonite feeds petroleum refinery. T. P. Forbath. *Chem. Engng*, 1957, **64** (11), 222–5.—A new refinery now on stream in Colorado produces high-O.N. gasoline and electrode grade coke from solid gilsonite, using no crude at all. Gilsonite is heated, then put through a delayed coker. The coke is calcined and sold. Oil produced is fractionated, Unifined, and then Platformed, the hydrogen requirement being satisfied by thermal reforming of the C_3–C_4 stream. P. J. O.

879. Select your pumps by specific speed. J. K. Jacobs. *Petrol. Refin.*, 1957, **36** (10), 145–6.—Specific speed can be used to avoid cavitation troubles, to select the most economical pump for a given process layout, and to assist in redesigning process conditions. This article presents a nomograph which permits rapid estimation of specific pump speed for any given process layout. J. R. T.

880. Calculate condenser pressure drop. J. E. Diehl. *Petrol. Refin.*, 1957, **36** (10), 147–53.—Prediction of pressure drop through horizontal tube banks, with condensation, has long been a problem in condenser design. The author has developed a new method which correlates the 2-phase pressure drop data in downflow condensers. A description is given of the test units used, and pressure drop data are presented for a wide range of physical properties and flow conditions. The 2-phase correlation enables the prediction of condensation pressure drop by a stepwise computation with an average deviation of 11%. J. R. T.

881. Scheduling design work. H. T. Campbell. *Petrol. Refin.*, 1957, **36** (11), 313–15.—The establishment of planned maintenance and construction programmes has proved to be very useful in the reduction of refinery costs. This article outlines several factors which contribute to the complexity of establishing a schedule for engineering design work in a modern refinery. The objectives of such a schedule are discussed, and the various steps to be considered in forming the schedule are outlined. J. R. T.

882. Modern trends in natural gasoline plant instrumentation. R. R. Click. *Proc. 36th ann. Conv., nat. Gas Ass. Amer.*, 1957, 18–22.—A discussion of 3 developments in instrumentation for continuous production processes as they specifically apply to the natural gasoline plant. These developments, which have evolved during the past 10 years, are: (1) use of pneumatic or electrical transmission between the measuring element and the recorder or controller; (2) the advent of small size recorder–controller combinations, commonly referred to as miniatures; (3) increased use of electronic control. Each is discussed with respect to performance, cost, and maintenance considerations as they apply to gasoline plant application. (Author's abstract.)

883. Utilization of normally wasted power in a natural gasoline plant. H. C. Givens. *Proc. 36th ann. Conv., nat. Gas Amer.*, 1957, 38–40.—There are 3 sources of normally

wasted power in a natural gasoline plant. These are exhaust steam above atm pressure, expanding gas, and rich absorption oil flowing from a high pressure to a lower pressure. Machinery at economical cost is readily available to utilize all this normally wasted power. (Author's abstract.)

884. New controller recorder gravitometer. H. A. Brainerd and J. J. Piros. *Oil Gas J.*, 2.12.57, **55** (48), 78.—A unit is described for automatically blending crudes to constant outgoing gravity, with a tolerance of ±0·1° API, at a rapid rate. G. A. C.

885. Good tube maintenance tools cut costs. A. John. *Petrol. Refin.*, 1957, **36** (11), 317–20.—One of the large operating costs, downtime for repair, can be kept at a minimum if boiler and heat exchanger tubes are kept clean. This article describes both tube cleaning and retubing equipment and provides instructions for the use of each type. J. R. T.

886. Cooling-tower water treatment. W. O. Gossom and J. O. Johnson. *Oil Gas J.*, 9.12.57, **55** (49), 91.—Use of shell-and-tube equipment in cooling water system calls for clean heat transfer surfaces, and supervision of equipment and chemical treating methods to prevent scale, corrosion, slime, and algæ.

Methods used at D-X Sunray Oil Co., Tulsa, are outlined. G. A. C.

887. How 31 refineries condition cooling-water systems. J. D. Helwig and H. F. McConomy. *Oil Gas J.*, 2.12.57, **55** (48), 101.—Effectiveness and cost of treating methods for cleaning fouled systems are discussed. Costs of adequate processes range from $1 to $5/day/1000 g.p.m. water circulated. Tables show cooling-water compositions before and after treatment, and effectiveness and cost of chemical treatment. G. A. C.

DISTILLATION

888. Multi-component flash calculations. J. B. Bachelor. *Petrol. Refin.*, 1957, **36** (10), 113–17.—A new method for the solution of flash equilibrium problems which reduces the actual number of calculation steps is presented. The first 3 terms of the Taylor series expansion are used to represent the flash function in the region of a vaporization point. The range of convergency is located by 2 very simple limiting equations which apply very accurately at close to max and minimum vaporization points. Calculations considered are those required to determine the extent of vaporization in a multi-component mixture of 2 or 3 phases of fixed total composition, pressure, and temp. J. R. T.

889. New method for V/L flash calculations. R. Salmon. *Petrol. Refin.*, 1957, **36** (12), 133–6.—2 procedures designed to reduce trial and error in the solution of certain types of equilibrium vapour–liq calculations are presented. The first method is useful when a make-up gas stream enters the system in addition to the main feed. The second method is applicable where the vapour phase from the flash is recycled through a scrubbing system back to the flash drum with one component being continuously removed. Examples are given to illustrate each method. The chief application of these methods is in process design studies involving economic decisions, where information must be developed in the form of curves relating the variables, and where a single point would be insufficient. J. R. T.

890. Where gilsonite becomes a premium motor fuel. D. H. Stormont. *Oil Gas J.*, 25.11.57, **55** (47), 97.—American Gilsonite Co. refinery near Grand Junction, Colorado, is producing 1300 b.d. of high-quality gasoline from the solid asphaltite, gilsonite. The processes used involve coking fractionation, hydrogenation, and Platforming. Coke is calcined to produce 275 tons/day of metallurgical coke A flow sheet is depicted. G. A. C.

ABSORPTION AND ADSORPTION

891. Spivey gasoline plant. J. C. Reidel. *Oil Gas J.*, 25.11.57, **55** (47), 102.—Magnolia Petroleum Co. operates a 30,000,000 cu. ft/day gas plant at Attica, Kansas. A particular feature is the automatic shut-down and alarm system. 3 plant emergency shut-down stations and 2 boiler and rich-oil heater emergency shut-down stations are provided. G. A. C.

SOLVENT EXTRACTION AND DEWAXING

892. The countercurrent flow of two immiscible liquid phases. (Capacity of spray extraction column.)—G. H. Reman. *Ingenieur, 's Grav.*, 8.11.57, **69** (45), 128–3.—A derivation is given of equations and correlations describing the countercurrent flow of 2 immiscible liq phases. It is based on the assumption that a Weber number relation holds true for the size of droplets in the countercurrent flow of these 2 phases and on the relationship for the relative velocity of particles in "particulate" fluidization of solids with liq. The equations have been applied to spray extraction columns, and a very good correlation with the observed max flow rates and with the hold-up of the dispersed phase under flooding conditions has been found. G. F. T. C.

CRACKING

893. Cracking in fluidized beds. (In German.) F. Rozendahl. *Chem. Zeitung*, 1958, **82** (1), 6–8.—The principles of fluidization are discussed, and the operation of fluidized bed cat crackers described. P. J. K.

894. Catalysed erosion in cat crackers. L. Resen. *Oil Gas J.*, 9.12.57, **55** (49), 101.—A series of case histories showing problems and solutions regarding erosion in fluid cat cracking units is given. G. A. C.

895. How to predict gravity flow rates. F. A. Zenz. *Petrol. Refin.*, 1957, **36** (10), 162–70.—This article reviews the major published studies in free flow of powders through restrictions. Specific and generalized correlations for the prediction of flow rates of solids through orifices are presented in graphical form. Application of these correlations to the calc of cyclone dip-leg capacity and sizing of cat lines in a T.C.C. unit are considered. The problem of segregation within bins and hoppers is discussed, and several methods of introducing the feed in order to ensure uniform distribution are outlined. Methods for ensuring uniform downflow, especially important in moving bed processes, are also considered. J. R. T.

896. Expansion of petrochemicals increases raw materials for Höchst. (In German.) Anon. *Chem. Ind.*, 1957, **9**, 542.—A short account of the expansion by Farberwerke Höchst A.G. in the production of olefins for petroleum chemical production. P. J. K.

897. Fluid catalyst design data. Pt 8. Contact efficiency influences design. F. A. Zenz. *Petrol. Refin.*, 1957, **36** (11), 321–8.—Despite the successful operation of fluid cat cracking units and other fluidized solid processes, the fundamental aspects of the mechanism of gas flow within the bed remain

unresolved. This article considers the problem of heat transfer, cat entrainment, and mass transfer in fluidized beds. 2 methods of obtaining good gas–cat contact in the fluid state are outlined, and 3 methods for dispersion of solids within the continuous fluid medium are discussed. A table is presented which attempts to classify the general qualitative pilot plant and commercial scale observations and ideas on particle-fluid contact in cat–gas systems. Several commercial applications of fluidization are discussed, including cat cracking, hydrocarbon synthesis, and nuclear power generation. J. R. T.

898. Thermal recuperation of T.C.C. tail gases by catalytic oxidation at Donges refinery. R. Morel and P. Simonnin. *Bull. Ass. franç. Tech. Pétrole*, 1957, 493–7.—Gases from cat regenerator of 12,500-brl T.C.C. unit passed through cat (Al_2O_3/Pt) combustion chamber (140 × 79 × 76 mm). Oxidn begins at 240°–400° C (depending on gas composition) and can proceed to 1000° C, although normally automatically kept lower to prolong oxidn cat life. Recuperator (temp rise of gases from *ca* 370° C to *ca* 700° C, oxidn cat bed temp *ca* 775° C) produces 10 tons/hr steam at 14 kg/cm². V. B.

HYDROGENATION

899. Making butadiene. 2. Butylene dehydrogenation by the steam-dilution method. J. C. Reidel. *Oil Gas J.*, 2.12.57, **55** (48), 87.—The current basic process for commercial production of butadiene from butylene is described, and a table shows feed preparation, cat dehydrogenation, gas recovery, and butadiene finishing; a flow sheet is provided. Results depend on type of cat. G. A. C.

900. Catalytic dehydrogenation of 1-methyl*cyclo*pentene-1. N. I. Chouikine and T. J. Narychkina. *Rev. Inst. franç. Pétrole*, 1957, **12**, 1075–8.—1-Methyl*cyclo*pentene-1 can be dehydrogenated to 1-methyl*cyclo*pentadiene-1 : 4 by passing over Al–Cr cat (K promoted) in a quartz tube at 20–25 mm Hg. Yields are given for 500°–650° C, max being 46·5% at 600° C. Analyses of gaseous and liq products are presented, showing that (in addition to dehydrogenation) demethylation, isomerization of the C_5 ring to C_6 with subsequent formation of C_6H_6, polymerization, and cracking also occurred. W. A. M.

901. Structure of products of low-temperature coal hydrogenation. J. P. Schuhmacher *et al. BrennstChemie*, 1956, **37** (7–8), 97–8.—Reaction products from fat coal (C 86·5%) hydrogenation are investigated. Liquefaction—without disintegration—dist, and extraction with selective solvents are discussed. The No. of rings per medium mol is calc from mol. wt., C and H_2%, *n* and *d*, for each fraction obtained. Assuming that the side chains of the cpds present in the fractions consist exclusively of CH_3-groups, it is possible further, to derive the type of ring condensation occurring, from the total No. of C-atoms, No. of C-atoms in CH_3-groups, and No. of rings of a fraction. R. T.

CHEMICAL AND PHYSICAL REFINING

902. Which CO_2 removal scheme is best? J. F. Mullowney. *Petrol. Refin.*, 1957, **36** (12), 149–52.—A comparison of the battery limits investment and operating costs for treating a gas stream containing *ca* 34% CO_2 down to 10–25 p.p.m. (by vol) by 7 different treating schemes is presented. The manner in which the plant investment and operating costs, both direct and indirect, were developed is discussed. The comparative yearly costs for CO_2 removal, together with the advantages and disadvantages of the various treating schemes, are presented. 2 factors primarily determining the total operating costs were found to be steam costs and plant investment. Treatment with hot potassium carbonate followed by aqueous monoethanolamine resulted in the most economical process scheme. J. R. T.

SPECIAL PROCESSES

903. Fluid coking secures wide acceptance. L. E. Carlsmith, R. R. Haig, and P. H. Holt. *Oil Forum*, 1957, **11**, 90–3.—Fluid coking described is a flexible, continuous process for upgrading a wide range of low-val stocks to gas oil, gasoline, and by-product gas and coke. The system—described and illustrated—resembles that of fluid cat cracking. Successful results have been obtained with atm residua with i.b.p. 600°–700° F or vac residua with i.b.p. *ca* 1200° F. Feeds with gravities as low as −3·5° API and Conradson C ratings as high as 41% have been processed. The major product is gas oil, boiling range 430°—*ca* 1015° F, desirable feed for cat cracking. Cuts of appropriate boiling range, after Hydrofining, may be included in heating oil. Naphtha produced has a relatively low O.N.; to increase product yield it may be included in cat reforming feed. Light ends, small in yield, contain high percentages of olefins. C_4 hydrocarbons are *ca* 75%, C_3 *ca* 60%, and C_2 *ca* 40% unsaturated. Fluid coke is being sold currently as public utility fuel. The process is economically sound. R. T.

904. The petrochemical industry. J. H. Shipley. *Engng. J., Montreal*, 1957, **40**, 1277.—Tech aspects and petroleum chemical development in Canada are discussed with supporting maps and charts. Further discussion and charts indicate the impact of the petroleum chemical industry on the oil industry. The growing and growth-stimulating petroleum chemical industry may be retarded by unrealistic raw material pricing, inadequate tariffs, and freight costs. The importance of tariffs is emphasized by ref to the U.S.A. and U.K. In freights Alberta is at a disadvantage to the Gulf Coast in terms of access to the major Canadian markets. In the E., new units being installed will produce petroleum chemicals from crude oil. It is unlikely that natural gas will be used. Surplus natural gas by-products from the W. would be welcome in the E. Raw materials, manufacturing processes, size and location of markets, freight, and tariffs are current and future factors in petroleum chemical plant location and industry development in Canada. Raw material sources are crude oil, domestic and imported; by-products from crude oil refining, chiefly off-gases occurring in the E; natural gas and its by-products, occurring chiefly in the W. Large variation in gas and raw material costs in different localities poses the question of economy, which has controlled the development pattern of the industry in Canada. Should advantage be taken of cheaper raw materials in the W. to ship the products to the major markets in the E., or should the dearer raw materials in the E. be used with consequent lower delivery charges on the finished product? R. T.

905. Symposium on low temperature gas separation. Anon. *Petrol. Times*, 20.12.57, **61** (1575), 1127.—A summary is given of papers from a symposium at the Royal Institution, London, on 21.11.57 on "Recent Developments in Industrial Low Temperature Gas Separation." Papers discussed include low-temp separation of hydrocarbon gases, air-separation processes, purification of hydrogen for dist, and design of low temp plant. G. A. C.

906. Acetylene production for petroleum chemicals. Anon. *Petrol. Times*, 6.12.57, **61** (1574), 1095.—A review is given of available processes for production of acetylene; all the hydrocarbon cracking processes consist essentially of heating the feedstocks to *ca* 1500° C and then rapidly quenching to

preserve the acetylene formed. Yield is *ca* 10 vol%. Ethylene, carbon monoxide, and hydrogen can be obtained as by-products. G. A. C.

907. Oil firing of down-draught kilns. C. A. Roast. *Fuel Effic.*, 1957, **12**, 584–9.—Construction and operation of the Beehive down-draught, coal-fired oven—producing heavy clay products—are described. Conversion to oil firing, with slight modifications, using 200-sec Red. I fuel at 100° F, as described, gave a satisfactory product, which justified further experiments. In further developments the temp cycle was modified to take advantage of the greater flexibility of oil firing. As a result, both the water-smoking period was reduced, and the firing rate accelerated to show an overall reduction of 20% on the normal kilning period. Bag modification gave additional kiln loading capacity. Closer damper-setting reduced oil consumption sufficiently to justify conversion of other kilns. Experiments on oil firing of quarry tiles, using 950-sec Red. I fuel, gave "scummed" product. Additional air ports solved the problem. With a normal setting of 36 tons of tiles, average coal consumption was 10 tons, representing a heat input of 83 therms/ton of saleable tiles, for an average firing period of 7 days. Following conversion to oil the standard of improvement was marked; thermal input was reduced by 25%, and 2 days were saved for each kilning. Cost of conversion is discussed. The article is well illustrated. R. T.

METERING AND CONTROL

908. Process control by continuous infra-red gas analysis. (In German.) H. Hummel. *Chem. Ing. Tech.*, 1957, **29**, 776–80.—The advantages of the single- and double-beam instruments are discussed and a single-beam instrument for process control described. An alternating beam which is measured and amplified by alternating equipment is used. P. J. K.

PRODUCTS

CHEMISTRY AND PHYSICS

909. This equation gives viscosity. L. F. Albright and K. K. Innes. *Petrol. Refin.*, 1957, **36** (12), 155–8.—A modified rate equation is presented which has been found to correlate the available visc data of normal paraffins, benzene, *iso*butane, 1-butene, and methyl *cyclo*pentane over wide temp ranges. The authors presume that the equation is applicable for other hydrocarbons in the aromatic, *iso*paraffin, olefin, and *cyclo*paraffin families. J. R. T.

910. Calculation of the hydration equilibrium of ethylene. J. Muller and H. I. Waterman. *Chim. et Industr.* (*Génie Chim. suppl.*), 1957, **78**, 173–86.—Method described for calculating equilibrium const for gases based on pressure (K_p) and introducing into the equations an expression for fugacity. Such new equilibrium const (K_f) corrected by means of the fugacity coeff (ϕ) of the gases present enables the relationships $K_f = K_\phi . K_p$ and $\phi = f/p$ to be derived, whence the extent of ethylene conversion at equilibrium can be obtained. Calc of the fugacity coeff of C_2H_4, H_2O, and C_2H_5OH, from various equations, is examined in detail and the results discussed. (Authors' summary.)

911. Pure substance enthalpy and entropy. M. Hobson and J. H. Weber. *Chem. Engng*, 1957, **64** (11), 245–50.—Pt III of a series on the thermodynamic properties of pure and mixed hydrocarbons, the article considers the data necessary to obtain these derived properties, reviews and compares the rigorous and generalized methods by which they are determined, and indicates what thermodynamic data is available in the literature. P. J. O.

912. Ion exchange. Application of ion exchangers in non-aqueous media. P. Renault. *Rev. Inst. franç. Pétrole*, 1957, **12**, 881–6.—Ion exchangers can be used for demineralization of unionized org cpds in aq or aq alc soln, for recovery of ionizable org cpds from aq soln, and for separation of polar org cpds from non-aq soln, an example of the last separation being removal of mercaptans from gasoline. A brief account is given of the principal factors involved in these operations, including resin regeneration; 29 refs, mainly to applications. W. A. M.

913. Study of catalytic reactions by means of vapour phase chromatography. J. Maréchal, L. Convent, and J. van Rysselberge. *Rev. Inst. franç. Pétrole*, 1957, **12**, 1067–74.—A brief introduction to GLC is followed by a schematic diagram and description of a set-up for continuously following the course of a cat reaction at atm pressure. A heated cat bed is incorporated in the mouth of a column; reactants, introduced just prior to the bed, are swept forward by carrier gas, which takes products on to column. For reactions at increased pressure a regulator reduces gaseous products from the reactor to atm pressure; products are then fed to the column by a gas sampling device; a schematic diagram is given. Isomerization of *n*-pentane to *iso*pentane over Platforming cat (430° C, 68 kg/cm, 1 vol/vol/hr, 3 : 1 H_2 : pentane) was studied using above technique. Chromatograms and graphs of cat activity are given for new and stabilized cat. W. A. M.

914. Isosteres and physicochemical phenomena. J. Larbre. *Rev. Inst. franç. Pétrole*, 1957, **12**, 995–1002.—By plotting the isosteres, similarities are shown to exist between apparently different phenomena, examples being friction at oil–metal interface, wettability of metal by hydrocarbons, surface visc of soap soln, stability of soap films and froth, coagulation of metal sols, and flocculation of soot particles in detergent oil. In each case a plot of log C against $1/T$ (C = concn of polar constituent, T = abs temp) consists of 2 straight lines. It is suggested that the transition point in each case corresponds to a physicochemical change in the system. W. A. M.

915. Electric strength of unsaturated hydrocarbon gases. A. E. D. Heylen. *Nature, Lond.*, 1957, **180**, 703.—The influence of mol structure on electrical breakdown has been studied for *n*-pentane and *n*-hexane and their *cyclo* derivatives, octane, hexene-1, and *iso*prene. Contrary to previous results, the relative composite cross-section of the C–C bond is found to be *ca* 1·0, the same as that of the C–H bond. The reasons for the discrepancy are discussed.

Correlation between breakdown measurements and u.v. spectra was good; thus both methods classed *cis*-butene-2 and *cyclo*pentane together, and distinguished them from *trans*-butene-2 (*cf.* Abs. **1835**, 1957). H. C. E.

916. Equilibrium constants via nomograph. N. W. Luft. *Chem. Engng*, 1957, **64** (11), 235–7.—The article presents and supplements published data on equilibrium constants, in nomographic form, listing particularly data for cracking and other hydrocarbon reactions at temp of 0°–1000° C. P. J. O.

917. Correlations in fluidized beds. M. Leva. *Chem. Engng*, **64** (11), 266–70.—The prediction of onset of fluidization, and of fluidized bed height, is discussed, using various graphs and nomographs. P. J. O.

918. Ion exchange. Methods of calculation and interpretation of experimental results. Y. L. Gladel. *Rev. Inst. franç. Pétrole*, 1957, **12**, 864–80.—3 methods of ion exchange, successive single-stage contacting, continuous countercurrent contacting, and percolation through a column, are treated theoretically, the first 2 by methods analogous to those used for solvent extraction and dist, and the third by the method of Hiester and Vermeulen (*Chem. Engng Progr.*, 1952, **48**, 505). A practical example of the third method is worked out. W. A. M.

919. Combustion of saturated hydrocarbons at low temperature. M. Lucquin. *Rev. Inst. franç. Pétrole*, 1957, **12**, 1079–119, 1168–97.—In the first part of this thesis, after a brief survey of published work on low temp combustion of org cpds, description is given of apparatus and technique used in a study of combustion of C_5H_{12} in the region 250°–450° C. Limits of the different types of combustion were determined. Influence of pressure, temp, relative concn of C_5H_{12} and O_2, and addition of H_2O_2, CH_3CHO, HCHO, and C are shown graphically. In the second part the results obtained are applied in the discussion of various problems in low temp combustion, *e.g.* propagation of explosions, similarity of emission spectra of cool flames to fluorescence of HCHO, development of an expression relating induction period to pressure and temp, the 2 areas of the first cool flame, mechanism of formation of multiple cool flames, chem and kinetic aspects of oxidn, and application. 98 refs. W. A. M.

920. Simplified method of measuring peak pressures. I. R. King and G. J. Gibbs. *Rev. sci. Instrum.*, 1957, **28**, 721.—For measurement of pressures with accuracy 5–10%, a sensitive check valve is connected directly to the explosion chamber and N_2 is introduced behind the valve to a pressure just below the expected peak pressure. At peak pressure the valve opens momentarily giving an increased gauge reading; the N_2 pressure is then adjusted in steps until finally there is almost no pressure increase. The gauge then indicates the peak pressure. H. C. E.

921. Prediction of critical temperatures. D. K. H. Briggs and W. D. Drake. *Nature, Lond.*, 1957, **180**, 1353.—The critical temp t_c of 14 paraffins, 25 aromatic hydrocarbons, 4 phenols, and 7 organic bases can be obtained from the empirical equation $t_c = 221{\cdot}6 + 1{\cdot}029t_bd$, where t_b is the b.p. (° C) and d is the (liq) density at 20° C (obtained by extrapolation for solids). The average accuracy is $\pm 5\%$, *i.e.* $\pm 20{\cdot}8°$ in the range 260°–530° C. The omission of 5 hydrocarbons reduces the limits of error to $\pm 14{\cdot}2°$. H. C. E.

922. Liquid–liquid equilibria at 25° C. J. Durandet. *Rev. Inst. franç. Pétrole*, 1957, **12**, 1161–7.—Triangular diagrams and tie-line data are given for the equilibria between $\beta\beta'$-oxydipropionitrile, n-C_7H_{16} and toluene, and between $\beta\beta'$-thiodipropionitrile, n-C_7H_{16} and toluene, at 25° C. It is concluded that the 2 nitriles are effective solvents for separating aromatics from low-boiling paraffins, the oxy-cpd giving extracts richer in aromatics. W. A. M.

923. Generalized Z chart for low pressures. H. W. Pfennig and J. J. McKetta. *Petrol. Refin.*, 1957, **36** (12), 153–4.—A generalized compressibility chart for light hydrocarbons is presented for a range of reduced pressure from 0 to 0·05 and reduced temp 0·75 to 1·9. The chart gives results to within 0·10% of the actual values. J. R. T.

924. Compressibility factors at low pressures. H. W. Pfennig and J. J. McKetta. *Petrol. Refin.*, 1957, **36** (11), 309–12.—The p–v–t behaviour of ethylene, propylene, and butene-1 has been studied, using a gas density balance, at 90°, 120°, and 150° F for a pressure range 400–1500 mm Hg. The compressibility factor isotherms are plotted for each of these hydrocarbons and the data compared with that of other investigations. The overall accuracy is stated to be such that the compressibilities are within 0·10% of the actual value. J. R. T.

925. Deflocculation in hydrocarbon oils. A. Bondi and H. Diamond. *J. Coll. Sci.*, 1957, **12**, 510–23.—The deflocculating effect of 3 types of dispersant additive in fractions of a Texas neutral oil (57 cS at 38° C) of varying aromatic content is measured for 2 varieties of carbon black which have a concn of 10% in the blend. The deflocculating effect, expressed in terms of conductivity changes of the blend, is measured in a cell with a rotating electrode, and the results are extrapolated down to shear rates of 2 sec^{-1}. Results are shown as plots of log (increase in resistance/resistance of flocculated particle system) *v.* concn of additive. In general, the curves pass through a max, which is stated to occur when the C surface is completely covered by additive.

The qualitative aspects of the system are discussed in general terms, and the following conclusions are reached: (1) all the additives in aromatic-free oil deflocculate acidic C black more effectively then neutral C black; (2) the composition of the oil has a much greater effect on the deflocculation of acidic than of neutral C black, because the intrinsically basic aromatics are strongly adsorbed on the acidic surfaces; (3) multi-layer adsorption is indicated in some cases. The dispersant performance of a strongly adsorbed polymeric deflocculant may be explained in terms of partial detachment in the form of chain loops that dangle from the interface into the oil. H. C. E.

926. Effect of high-energy radiation on polypropylene. R. M. Black and B. J. Lyons. *Nature, Lond.*, 1957, **180**, 1346.—Samples of Ziegler polypropylene (mol. wt. ~90,000) were irradiated for known times in a beam of 2 MeV electrons. The number average mol. wt. decreased steadily in a manner which can be deduced from the assumption that random breaks occur in the main polymer chain in number directly proportional to the radiation dose. Extraction of the irradiated polymer with boiling toluene yields a cross-linked gel fraction, and it would appear that for every cross-link formed *ca* 1·6 bonds between monomer units are broken during irradiation.

I.r. spectra show that in addition to the above changes unsaturation of the type RR′C : CH_2 and perhaps RCH : CHR′ is introduced. It is suggested that the mol degradation proceeds by a disproportionation mechanism. H. C. E.

ANALYSIS AND TESTING

927. Apparatus for the measurement of small angles of contact between liquids and solids. A. L. Speece, C. P. Rutkowski, and G. L. Gaines. *Rev. sci. Instrum.*, 1957, **28**, 636.—The apparatus consists of a plate suspended from 2 vertical micrometers 6 inches apart in a trough containing the liq. The plate, 7 inches long and 2 inches wide, can be of the material under investigation, or it can be of steel, to which the material is fastened. In use the plate is set parallel with the liq surface by means of a cathetometer; it is then lowered into the surface and tilted until the liq surface remains horizontal right up to the solid/liq interface. The difference in micrometer readings then gives a measure of the contact angle. Angles of 10° can be measured with an accuracy of $\pm 0{\cdot}04°$. H. C. E.

928. Simple gas analysis apparatus for estimating CO_2, CO, O_2, and N_2 in gas mixtures of a few cm^3 NTP. M. Rossberg. *BrennstChemie*, 1956, **37** (7–8), 121–2.—A simple apparatus for estimating very small quantities of CO_2, CO, O_2, and N_2 in combustion gases—consumption of graphite tubes—is described and illustrated. Single constituents are estimated after manometric separation of CO_2 and CO. The analysis of a specific mixture is given. CO and H_2 are estimated separately in their mixture as given in an aux part. R. T.

929. Structural analysis of petroleum hydrocarbons with radioactive isotopes. I. H. Umstaetter. *BrennstChemie*, 1956, **37** (7–8), 109–13.—Recently developed methods for structural analysis of higher hydrocarbons are reported. From elementary analysis, *d*, *n*, mol. wt., and velocity of sound, the No. of C-atoms in paraffinic, naphthenic, and aromatic combination are determined as rapidly and more accurately than by the an. pt. method. R. T.

930. Description of operation to determine volatile components in coal–high-temperature-coke. G. Lange. *BrennstChemie*, 1956, **37** (7–8), 106–8.—Estimation of traces of volatile constituents in coke is described. The sample is heated under accurately defined conditions for 60 minutes at 875° C in the illustrated apparatus. Gases evolved are forced with an A-stream through absorption tubes and their quantity and composition determined. The procedure gives reproducible results. Limits of error are tabulated. R. T.

931. High-efficiency columns for analysis of hydrocarbons by gas–liquid chromatography. R. P. W. Scott and J. D. Cheshire. *Nature, Lond.*, 1957, **180**, 702.—Important factors affecting column efficiency are the correct grade of column support, quantity of liq phase, and the dimensions of the column. Column efficiencies of 12,000 theoretical plates can be obtained by a specified choice of conditions, which are such that the column efficiency is an approx linear function of column length. If the total charge exceeds 400 μg or if any individual component exceeds 80 μg tailing is obtained and the efficiency falls.

Under the specified conditions *m*- and *p*-xylene can be separated in a mixture of 12 hydrocarbons, using a column length of 25 ft. H. C. E.

932. Gas chromatography. C. S. G. Phillips. *Nature, Lond.*, 1957, **180**, 840.—Report of an International Symposium on Gas Chromatography held at East Lansing, Michigan, Aug. 1957.

Many of the papers were concerned with the application of gas chromatography to specific problems in the analysis of gasoline, halohydrocarbons, glycols, etc. Others were devoted to detailed descriptions of apparatus, especially in connexion with commercial gas chromatographic equipment. H. C. E.

933. The analyst and infra-red spectroscopy. A. E. Martin. *Instrum. Pract.*, 1957, **11**, 1146–53.—Recent developments in i.r. spectroscopy are surveyed, including apparatus, accessories, sampling, standardization and operation of equipment, and techniques for specialized problems. W. A. M.

934. Infra-red snapshots measure tank levels. C. H. Chilton. *Chem. Engng*, 1957, **64** (11), 138.—A new far i.r. camera enables thermal photographs of objects to be produced within 3 minutes. It is useful in the range 0°–500° F, and records temp differences of 0·4° F. Suggested uses include measurement of tank levels, and investigation of temp in process or electrical machinery, simply by photographing these objects. P. J. O.

935. Recommended methods for the analysis of trade effluents. Method for the determination of synthetic detergents. Anon. *Analyst*, 1957, **82**, 826–34.—Prepared by joint ABCM and SAC committee. For concn of anionic detergents of 20–150 μg Longwell and Maniece's method (*Analyst*, 1955, **80**, 167) is recommended; this involves colorimetric estimation of a $CHCl_3$ extract of the detergent–methylene blue complex. Tentative methods are given for high concn (>10 mg/l) of anionic detergents by titration with cetylpyridinium bromide or cetyltrimethylammonium bromide, for high concn (>10 mg/l) of cationic detergents by titration with Manoxol O.T., for low concn (<10 mg/l) of cationic detergents by reduction of anionic activity, and for non-ionic detergents (>10 mg/l) by pptn of a detergent–Ba molybdophosphate complex, which is subsequently estimated spectrophotometrically or colorimetrically. Tentative methods are also given for mixtures of anionic and cationic detergents, employing a cation-exchange resin for absorbing cation-active material. W. A. M.

936. Apparatus for measuring very low interfacial tensions. H. Y. Jennings. *Rev. Sci. Instrum.*, 1957, **28**, 774–7.—A pendant drop apparatus for rapidly measuring very low interfacial tensions is described. Interfacial tensions as low as 0·001 dyne/cm have been measured at 25° C in a water–oil system. These measurements were made possible through the combined use of small drop-forming tips, long working distance objectives, and electronic flash illumination. Examples of measurements on water–oil systems are given. The apparatus is designed to provide interfacial tension data as a function of temp, and the method permits the measurement of interfacial tension as a function of the age of the system. (Author's abstract.)

937. Testing station for deep well pumps and technical delivery-taking. W. Dubis. *Prace Instytutu Naftowego*, No. 44, Series A, 1956.—Since most of deep well pumps delivered to the Polish petroleum industry are of foreign origin, the Mechanical Committee and Scientific Council of the Polish IP has produced a set of rules to enable checking to be carried out on newly delivered pumps, margins of error allowed, and consequent grading of pumps. 4 tables and 4 graphs. M. S.

938. The Radiochemical Centre at Amersham. Anon. *Petrol. Times*, 3.1.58, **62** (1576), 13.—The two new buildings at the Centre, which is within the Research Group of the U.K. Atomic Energy Authority, will enable the Centre to meet the increasing demand for radioactive products which find an application in the oil industry. Processed isotopes are made by chemical separation from materials irradiated in the piles at Harwell and Windscale and in the cyclotron at Birmingham University. G. A. C.

GAS

939. Gathering and processing natural gas. J. M. Dillon. *Engng J., Montreal*, 1957, **40**, 1265.—Analyses of gases from Alberta fields range from sweet and volatile-rich to lean, extremely sour. Gases and associated liq are transported to a central plant by common or 2-phase gathering lines for separation and processing. The major problem is hydrate formation prevention, by heating, or inhibiting by passing through silica gel or through a bubble plate column containing glycol. A typical gas contract specifies H_2S max 1 grain/cu. ft., min cal. val. 1000 B.t.u/cu. ft.—to restrict non-combustible cont—and hydrocarbon and H_2O dewpoints $\geq$15° F at 800–900 p.s.i.g. to avoid condensation with pressure drop and line capacity decrease. To meet sales contract spec H_2O, volatiles, CO_2, and H_2S must be removed;

plant and process are described. S plants often employ 2 conversion stages to recover 85–90% of the S in the gas feed, of >99·5% purity. In processing sweet, volatile-lean gas, costs are offset by income from by-products. In the case of sour reserves, processing costs are only partly defrayed by value of by-products. R. T.

940. What's ahead for gas liquefaction? C. H. Simonds. *Petrol. Refin.*, 1957, **36** (10), 105–7.—The liquefaction of natural gas is important in 2 fields of application, namely, in large vol storage and in transportation by barge or tanker. This article outlines several of the problems to be considered in order to ensure economic liquefaction of the gas. The main difficulties occur in the design of low temp storage systems for the liquefied product and also in the utilization of the great quantity of " cold " available from the regasification process. The profitable use of this refrigerant may well be the difference between profit and loss of the entire project. J. R. T.

941. Is ethane from natural gas economical? D. P. Penick. *Petrol. Refin.*, 1957, **36** (10), 108–12.—Although ethane is often present in large amounts in the field gas of many processing plants, very little of it is ever recovered for use as a petroleum chemical raw material. This article considers the economics of ethane recovery and discusses several processes available for this purpose. Although complete recovery is possible by some of these methods, it is not economically feasible, and a recovery of 70–85% represents the realistic upper limit. Data given for max investments for the recovery of 5 M.M. s.c.f/D of ethane show that many plants could install such facilities as attractive investments. J. R. T.

942. Problems of importing natural gas. A. R. Myhill. *Chem. Proc. Engng*, 1958, **39**, 24–6.—The North Thames Gas Board is to import 2000 tons of liq CH_4 from Venezuela. Problems associated with transport, storage, and use of this material are briefly considered. W. A. M.

943. Carbonizing steels using natural gas. J. Tyczynski and J. Werynski. *Prace Instytutu Naftowego*, No. 46, Series A, 1956.—When natural gas consisting mostly of methane is heated to 250° C it begins to decompose into C and H_2, and at 900°C the CH_4 is present only in 2%. The reaction is catalysed toward decomposition by Fe. Furthermore, presence of oxygen (less than theoretical amount) aids the carbonization by removing H_2, and moisture helps the process too. Positive results were obtained on lab scale by the Polish IP in 1950–52. Industrial-scale experiments at the Equipment Factory at Glinek and analytical work at the Silesian Polytechnic, Gliwice, are described. Gas used came from the gas grid, and was analysed as 90·6% CH_4, 0·8% CO_2, 0·1% O_2, and 8·5% N_2. Work was done in a muffle furnace, which is described. Several tables give details of steels treated, results obtained on them, hardness, thickness of carbonized layer; micro- and macro-structure are described with photographs to illustrate them. On the whole, the new method is thought to be a success, particularly for continuous working. The best steels to be so treated are Cr and Cr–Mn. M. S.

944. Natural gas in Scotland. T. J. Ricketts and D. C. Elgin. *Nature, Lond.*, 28.12.57, **180** (4600), 1444.—The first example is described of natural gas in Great Britain being distributed for town gas supply in Musselburgh and several smaller places locally. The gas, principally methane, and with a cal. val. of between 930 and 960 B.t.u/cu. ft., occurs near Cousland, and was discovered in 1938. At least 1000 million cu. ft. of gas are likely to be available and a 4-inch dia main conducts the gas to Musselburgh. G. A. C.

ENGINE FUELS

945. Recent engine developments in relation to fuels. D. Downs. *Petrol. Times*, 20.12.57, **61** (1575), 1133.—Extracts are given from a recent paper presented to the IP by the author. Steady rise in compression ratio of spark ignition engines is traced, and development of the diesel engine, gas turbine, and free piston engines discussed. G. A. C.

946. Contributions to knowledge of motor fuels. III. Radiation sensitivity of power fuels. G. B. Willfang. *Brennst-Chemie*, 1956, **37** (7–8), 113–16.—Occurrence of massed impurities, unstable and sensitive to light and radiation, or intensified demands on storability and stability of the hydrocarbons, necessitate special pre-storage treatment. Carbonyls are decomposed only by strong acids and free halogen or light effects, they are especially insol in H_2O, but readily sol in hydrocarbons. Thus, they remain unaffected during production and are harmful in the final product. Phenols, thiols, thiophenols, quinone, di- and polyenes, which may be present, are removed easily and are less harmful in heavy-duty fuels than carbonyls. The question arises whether, and to what extent, small amounts of substances unstable to radiation may be permitted, and to what degree the fuels can be protected against radiation influences and or stabilized, also with regard to isotopic research and atomic technique. 15 refs. R. T.

947. The testing of aircraft fuels. Anon. *Petrol. Times*, 3.1.58, **62** (1576), 14.—The U.S. National Bureau of Standards has recently developed a reliable method for estimating heat of combustion of aviation fuel based on an empirical equation relating heat of combustion to the proportion of various hydrocarbon types present. G. A. C.

GAS OIL AND FUEL OIL

948. Stability and miscibility of fuel oils. T. M. B. Marshall. *Schweiz. Arch. angew. Wiss.*, 1957, **23**, 273–9.—Stability of fuel oil is resistance to formation of non-waxy, dry, C-rich deposit, on storage and/or heating; 2 or more fuel oils are compatible if no such precipitate is formed on mixing. The physical structure of fuel oils is discussed and the importance of asphaltene–maltene equilibrium and dependence of oil stability on extent of asphaltene peptization are explained. Mixing sequence is important, dist should be added to residual oils, and not vice versa. Test methods (*cf.* Abs. **1464**, 1952; **334**, 1954) are described. Additives are of doubtful value, since aromatics require an uneconomic quantity, whilst for surface-active agents and soaps concn range can be critical. V. B.

LUBRICANTS

949. Estimating wear of internal combustion engines by means of oil tests. F. P. Malschaert. *Ingenieur, 's Grav.*, 28.6.57, **69** (26), M9–17.—The first part of the paper gives a brief survey of different methods by which the lub oil used in an I.C. engine may be analysed chemically for metal content, either as finely dispersed metal or as organo-metal salts. The sludge retained by the oil filter should not be neglected, since modern filters retain more impurities than those present in the crankcase.

The second part describes the application of spectrographic methods for measuring the wear in gasoline I.C. engines with doped or undoped lubricants. The results prove that wear is reduced by the dope and that the method is sensitive enough to detect small differences in wear. 4 figs, 31 refs, 15 tables. G. F. T. C.

950. Lubrication with molybdenum disulphide formed from the gas phase. F. P. Bowden and G. W. Rowe. *Engineer, Lond.*, 1957, **204**, 667.—A film of MoS_2 formed on the surface of Mo by heating in H_2S gave a low coeff of friction ($\mu = 0{\cdot}2$) and was stable up to 900° C. To apply the technique to Mo coated steel, it is preferable to plate the steel with Ni before spraying on the Mo, otherwise the H_2S attacks the substrate metal through the Mo layer and the coating may spall off. Should the MoS_2 film be destroyed by rubbing, it is readily reformed in H_2S, so that a gas may act as an effective lubricant if it reacts with the surface to form a cpd of the appropriate structure. A. C.

951. Lithium greases. S. Patzau. *Bull. Polish Inst. Petrol.*, 1957, **7**, 3–4 (Suppl. *Nafta (Krakow)*, 1957, **13**).—Lithium greases, *i.e.* Li soaps of higher fatty acids, have been introduced since the last war, and due to their resistance to moisture they are placed in the highest quality group. They are, moreover, plastic at −60° C, which makes them suitable for aircraft lubrication, but for most satisfactory service in those temp esters of dicarboxylic acids are better than mineral oils. Other substitutes are siloxanes (methyl, phenol). In Li soaps 54% is LiOH, which is introduced as $LiOH.H_2O$ or as carbonate. Oxidn inhibitors are required. In greases these soaps form 7–10%. Some excellent greases have been formulated at the Polish IP. It appears, however, that oxidn susceptibility depends on the metal of which the boiling kettle is made, Cu increasing this susceptibility tenfold as compared with enamel. M. S.

952. Contribution to the study of lubricated friction. J. Baudry. *Rev. Inst. franç. Pétrole*, 1957, **12**, 951–94.—Pt 1 of this thesis is a study of factors influencing coeff of friction (f) under boundary lubrication conditions in an expt bearing assembly, which is described. Method of determining f was checked by comparing determined val under hydrodynamic lubrication conditions with theoretical val. Effects on f under boundary lubrication conditions of surface state, load, speed of rotation, oiliness and visc of the lubricant, and the use of oiliness additives were investigated, and conditions for thermal stability were studied, the V.I. of the lub oil having an important effect. It was shown that, under high rates of shear in the bearing, V.I. improvers had no effect on oil visc. The results are interpreted by assuming that friction between 2 bodies varies inversely with the square of their distance and that methods of calculating oil film thickness remain valid under boundary lubrication conditions. Pt 2 is a study of the relation between lubricant visc and mechanical efficiency of a Citroen engine (1911 ml), determined by a strobomechanical gauge, description of which is given. W. A. M.

953. Some friction problems of the ATAR turbojet. K. Touré and R. Lerner. *Rev. Inst. franç. Pétrole*, 1957, **12**, 1198–214.—The major problem was friction between the shaft and pinions of the fuel pump; this was investigated, first on the lab scale and then on actual pumps on a test bed. Reduced wear and seizure could be obtained by treating (sulphinuzation) the metal surfaces, or by polishing in presence of additives (unspecified). Other friction problems of the ATAR turbojet are discussed briefly. W. A. M.

954. Surface properties and polishing. R. Brun. *Rev. Inst. franç. Pétrole*, 1957, **12**, 944–9.—The necessity for polishing moving motor parts is considered with reference to surface roughness and shape of the parts and their related bearing surfaces. At present it is necessary to specify narrow tolerances and then to polish. This, however, is due to ignorance of the true requirements; further research is necessary to specify optimum surface conditions required. W. A. M.

955. Lubricated friction under severe conditions. J. Pomey. *Rev. Inst. franç. Pétrole*, 1957, **12**, 754–80, 887–914.—Under severe conditions of pressure and temp, special precautions must be taken against seizure of lubricated metal surfaces. Thermal aspects of the problem are considered mathematically and the concept of a seizing crit temp is developed. Influence of nature and chem treatment of metal surfaces on wear and on coeff of friction was investigated, using 4-ball and other machines. Similar investigations on effects of acids and org S and Cl cpds used as lub oil additives are reported. A series of conclusions is presented. W. A. M.

956. Adoption of the viscosity–temperature index (V.T.I.) for lubricating oils. J. L. Groff. *Rev. Inst. franç. Pétrole*, 1957, **12**, 1003–32.—It is shown mathematically that the V.T.I. (*cf.* Abs. **2026**, 1957) can be accurately determined from the visc at any 2 temp. This finding is applied to enable the V.T.I. to be calc from visc at temp normally used in U.S.A. (100, 210° F), Europe (50, 100° C), and Britain (140, 200° F), by means of the expressions: $V.T.I. = X(W^{100} - W^{210}) = Y(W_{50} - W_{100}) = Z(W^{140} - W^{200})$. Tables are given of W, X, Y, and Z for visc 2–100 cS, and of W for visc 100–10^6 cS (formulæ are given relating X, Y, and Z to W). W. A. M.

957. New synthetic hydraulic fluids. Anon. *Chim. et Industr.*, 1957, **78**, 562–4.—2 materials, FH4 and FH8, have been developed by French Air Ministry and will be commercially available. Basis is alkyl silicate + polymerized unsaturated ester (FH4) and the same with addition of silicone (FH8). Characteristics, including stability tests, are listed. V. B.

958. A-power lubricants cost 10% more. Anon. *Elect. World*, 1957, **148** (22), 100.—Radiation-resistant lubricants have been developed for the British nuclear power programme by Shell Petroleum Co, and cost *ca* 10% more than ordinary lubricants. The effects of radiation on normal lubricants is discussed, and the properties required by a lubricant for a nuclear power station reviewed. P. J. K.

959. Study of E.P. lubricants by the four-ball testing machine. III. C. Paleari, C. Siniramed, and A. Girelli. *Riv. Combust.*, 1957, **11** (11), 715–34.—The paper deals with the conditions of boundary lubrication as well as with the mechanism of action of those additives which, through the formation of anti-wear or anti-welding films, prevent seizure of contact surfaces. Results are set forth and discussed of tests performed with the 4-ball testing machine by the accelerated method proposed by the authors. The results refer to a series of samples obtained by adding to the same base oil E.P. additives of varying composition (cpds of sulphur, chlorine, phosphorus, and lead soaps). The best results were achieved with sulphur base additives, which, however, display a certain corrosive action on the metal surfaces. (Authors' abstract.)

BITUMEN, ASPHALT, AND TAR

960. Bitumen research in Hungary. (In German.) M. Freund, Gy. Nyul, and P. Zakar. *Chem. Tech.*, 1957, **9**, 573–6.—The discovery of the Nagylengyel mineral oil in 1951 initiated extensive research in the field of bitumen processing, because a large amount of good quality bitumen can be produced from this oil, which from many standpoints does not lag behind the well-known Mexican bitumen.

The research work was organized and co-ordinated by the Hungarian Mineral Oil and Research Institute, where several new processes were developed to produce bitumens meeting special requirements. Basic relations were established between the way of processing and the composition and physical properties of the products. The properties of various dist and blown bitumens are summarized in tables, and special

attention is paid to the correlation between their m.p. and penetration. From the results of the work it was concluded that for establishing the suitability of a bitumen for a certain purpose not only the m.p. and penetration index but also the other properties must be taken into consideration. On the basis of results some new applications were suggested for special bitumens. W. R. H.

961. Mineral oil bitumens in the briquetting industry. (In Hungarian.) P. Zakar and Gy. Mozes. *Magyar Kem. Lapja*, 1957, **12** (5–6).—Generally coal tar pitch is used to produce coal briquettes. However, in Hungary the briquetting industry became the biggest bitumen consumer during recent years after the discovery of the bituminous mineral oil in Nagylengyel. The article gives a survey of the most important physical properties of various dist and blown bitumens compared to those of pitches of different origin. Rheological properties, grindability, heat sensitivity, high temp visc, coking properties, and adhesion characteristics are compared, and it is concluded that the "pitch-type" Hungarian bitumina are especially suitable for briquetting purposes. When choosing the right technology bitumens of high cohesion, high heat resitivity, *i.e.* high visc (small penetration) at ambient temp and of low visc at higher temp, and of high coking residue can be produced at an economical price.

Recently, instead of grinding, the bitumen is melted and atomized on the surface of the coal particles, which also makes possible the use of non-grindable types for briquetting.

In addition to the technical points, the economy of the processes was also studied during pilot plant experiments, and the applicability of various bitumens was established.

W. R. H.

962. Compaction control of asphalt paving. H. G. Nevitt. *Rds & Str.*, 1957, **100** (12), 122.—The amount of consolidation of the material and the control of compaction is discussed, and efforts made to correlate lab procedure are reviewed. A consultant's remarks on pneumatic rolling are also given. G. A. C.

963. Group analysis of asphalts. O. Geschwind. *Prace Instytutu Naftowego*, No. 45, Serial B, 1956.—Using the modified method of Lysykhin, several asphalts have been analysed to elucidate their physical properties and active groups in them. Elemental analysis shows C, 82–87·4%; H, 10·3–12·5%; O, up to 2·5%; S, 0·3–7·5%; N, up to 1·0%. The various kinds of hydrocarbons present are asphaltenes with 6–7·2% of O and *ca* 0·6–0·7% S, rosins with 4–5% of O and ½–1% S, oils, carbenes, carboids, asphaltogenic acids and their anhydrides. Polish asphalts having been so analysed and subjected to the usual tests, results obtained were graphed in groups to show the variation of each property through the various sources of asphalt, but although an attempt at this has been made it appears impossible to relate changes in any property to variation of the composition of the asphalt. M. S.

964. Viscoelastic properties of a high-consistency asphalt. A. B. Brown, J. W. Sparks, and F. M. Smith. *J. Coll. Sci.*, 1957, **12**, 283–93.—High-consistency asphalts behave, rheologically, in the complex viscoelastic pattern common to many macromolecular species. A correlation with accepted linear viscoelastic theory has been developed for the behaviour pattern, under tensile test conditions, of a special hard asphalt (soft. pt. 193° F; pen at 77° F, 50; duct at 77° F, 2·1) in creep, creep recovery, and stress relaxation. The same simple viscous and elastic moduli are found to determine these several action modes. The range and magnitude of discrete moduli have been determined from the empirical creep time and creep recovery time relations. Calculated values of stress relaxation compare favourably with direct experiment. (Authors' abstract.)

SPECIAL HYDROCARBON PRODUCTS

965. Gas evolution in capacitors. P. G. Morgan. *Elect. Times*, 1958, **133**, 176–7.—Summary of some recent Russian work on capacitor oils (*cf.* Abs. **374**, 1957). V. B.

966. Effect of side-chains in aromatic compounds on the behaviour of petroleum oil in an electric field. V. T. Renne and Tsyui Si-sin. *Zhur. Tekh. Fiz*, 1957, **27**, 1462–5.—Using previous technique (*cf.* Abs. **374**, 1957) 3 test oils (% C_A 3·0–17·4; % C_N 37·9–50·6) were compared (50° C, 25 kV/mm, 50 c/s) for gas evolution with standard condenser oil, which (from comparison of i.r. spectra) was less aromatic, and with such oil containing 15% added C_6H_6. Results with latter were outstandingly superior, even to those with the oil having 17·4% C_A; this is probably due to interfering effect of side-chains in the naturally occurring aromatic constituents, and this hypothesis is supported by results of tests with standard oil containing 15% of toluene or of ethylbenzene, giving results successively inferior to those with 15% C_6H_6. Very low gas evolution was shown by pentachlordiphenyl, the use of which as condenser impregnant is recommended; similar results were obtained with castor oil, but high loss factor of latter restricts its application (*e.g.* to impulse condensers). V. B.

DERIVED CHEMICAL PRODUCTS

967. Thermo data for petrochemicals. K. A. Kobe and R. H. Harrison. *Petrol. Refin.*, 1957, **36** (10), 155–9.—This article presents thermodynamic data for the chloroethanes over a temp range 273°–1500° K in both c.g.s. and English units. The properties listed include heat capacity, entropy, enthalpy function, and free energy function. Incomplete data on the heat and free energy of formation of these cpds are also included. J. R. T.

968. Chemicals manufactured from petroleum and their recent development. G. H. Visser. *Chim. et Industr.*, 1957, **78**, 603–11.—Lecture. Raw materials are divided into 4 main groups, CH_4, gaseous olefins (ethylene, propylene, butylene), liq olefins (C_6–C_{15}), aromatic hydrocarbons (BTX). Main conversions of each group tabulated. Brief mention of work of Natta on stereospecific polymerization of olefins (*cf.* Abs. **1796**, 1957). V. B.

969. Petrochemical handbook. Anon. *Petrol. Refin.*, 1957, **36** (11), 193–304.—A complete and up-to-date handbook of petroleum chemical processes is presented. New developments and products from older petroleum chemicals, along with new products, which ensure rapid expansion of the industry, are discussed. A total of 95 process descriptions and flow diagrams, falling under 2 main headings, namely, process section and separation section, is given. J. R. T.

970. Which polyethylene is best? J. W. Haun. *Petrol. Refin.*, 1957, **36** (12), 121–3.—The tremendous growth of polyethylene manufacture has caused serious trouble in assimilating the equally rapid changes in its technology. The author classifies the different polyethylenes into 3 arbitrary classes, "low," "high," and "intermediate," and considers the characteristics of each of these types. He concludes that there is no "best" product except as that applies to a specific use under specific conditions. J. R. T.

971. Preparation of secondary alkyl sulphate detergents from domestic raw materials. M. Maretic. *Nafta (Yugoslavia)*, 1957, **8** (11), 351–60.—This study has been undertaken in order to examine the possibilities available to the Yugoslav petroleum industry for producing detergents of secondary alkyl sulphate type. Basic materials used were "Irak" paraffinic wax, which is a refining by-product of lub oil; crude residues "Bunjani," "Mramor Brdo," and "Klostar"; and shale oil feedstock "Aleksinac." A small lab coking apparatus was used both for preparing dist rich in olefinic constituents from paraffinic wax, and for preparing dist from vacuum residues. Sulphation of dist was carried out by usual lab method. Principal variables of sulphation are presented, namely, acid concn influence, acid to sulphated material ratio influence, and temp and time influence. Product yields at optimum conditions of sulphation are 80–90% by wt for dist with boiling range 150°–300° C, produced by wax cracking, 22–24% by wt for dist produced by coking vacuum residues, and 28% by wt for shale oil feedstock dist. The examinations of characteristic qualities of sulphur products show that the shale oil products by their wetting power are superior to other sulphur products. Washing tests carried out with products prepared from dist of cracked wax gave satisfactory results. (Author's abstract.)

972. Synthetic detergents and emulsifiers. J. W. McCutcheon. *Soap, N.Y.*, Dec. 1957, **33** (12), 59.—Tables give trade name, manufacturer, class, formula, main uses, form, concn, and type of current detergents and emulsifiers in alphabetical order. The list completes the A's and commences the B's, and is to be continued. G. A. C.

COAL, SHALE, AND PEAT

973. New insight into coking phenomena. D. W. van Krevelen. *BrennstChemie*, 1956, **37** (7–8), 101–6.—Plastometer, dilatometer, and thermal balance are used to penetrate the mechanism and chemism of coal softening and degassing. A suitable working hypothesis is established on substance mixtures on a synthetic resin basis, of known structure and reaction mechanism, which exhibit at relatively low temp (70°–100° C), the same rheological properties as coal at *ca* 400° C. The coal softening is assumed to rest on a type of depolymerization and cracking of the resulting metastable intermediate products and recondensation of the radicals formed. The metastable liq intermediate (Metaplast) is considered as the plasticizer of coal. Working out the mathematical formulation of this hypothesis leads to a surprisingly fine interpretation of numerous experimental observations. Observations of the abs plasticity val indicate that coal particles in caking mostly retain their individuality, and there is no question of a true fusion. A kinetic observation of after-gasification gives a true explanation of the known fact, that heating to a definite temp stage causes a more or less sp end composition. R. T.

974. Underground low-temperature carbonization of oil shale after Ljungström der Svenska Skifferolje A.B. in Kvarntorp (Sweden). H. Munderloh. *BrennstChemie*, 1956, **37** (7–8), 119–21.—The unique plant, operated electrically, for underground oil dist from shale, is described with supporting diagrams. The low cost of current ensures economical working. R. T.

MISCELLANEOUS PRODUCTS

975. Brake fluid manufacturing. L. E. Carr. *Soap, N.Y.*, Nov. 1957, **33** (11), 61.—Properties of brake fluid raw materials, processes involved in the manufacture of 5 different types of brake fluid, and problems involved in the production are dealt with. G. A. C.

CORROSION

976. Heat-resistant steels and nickel alloys. W. Betteridge and R. Butcher. *Ingenieur, 's Grav.*, 28.6.57, **69** (26), Ch 93–1.—Various metals are reviewed, including low alloy steels, corrosion and heat-resisting steels, and high nickel alloys. Typical physical and mechanical properties are given. The importance of creep strength at elevated temp is discussed and the creep properties of certain materials compared. Reference is made to oxidn, carburization, sulphur, and oil ash attack. (Authors' abstract.)

977. Alloy electrical material may be cheap. J. M. Bryan. *Petrol. Refin.*, 1957, **36** (10), 129–30.—The corrosion of electrical materials in corrosive locations has been receiving attention for many years, but only recently has the use of corrosion-resistant materials been exploited to the fullest advantage. This article discusses the use of stainless steels and bronze alloys as overhead static wires, aerial cable messengers, and conduits. 5 criteria are presented which can be applied to justify the choice of such materials from an economic standpoint. These include minimum life expectancy, need for continuous uninterrupted service, routine maintenance during useful life, cost of ultimate replacement, and final salvage value. J. R. T.

978. Plastics vie with metals. J. H. Kelleher. *Chem. Engng*, 1957, **64** (11), 296–304.—The uses and limitations of thermosetting plastics in process applications are discussed, data being given on the tensile strength and modulus of elasticity of important materials and on flammability, weathering, rigidity, allowable working pressure, thermal expansion, etc. P. J. O.

979. Protection of plant and equipment in the petroleum and chemical industries. H. B. Footner. *Chem. Proc. Engng.*, 1958, **39**, 15–18, 33.—After outlining factors causing corrosion the ext painting of steel structures is considered, current British and U.S. practices being described. Int treatment of tanks, ext and int protection of pipelines, and lining of drums are discussed. New protective materials include epoxy resins and combinations of amine-cured epoxy resins and coal-tar pitch, and new techniques include a method of int coating of an existing pipeline. W. A. M.

980. High temperature hydrogen sulphide corrosion in commercial Sovaformer units. Pt 1. E. B. Backensto, R. D. Drew, and J. N. Vlachos. *Corrosion Tech.*, 1958, **5** (1), 14.—Sovaforming, a 3-reactor, fixed-bed process, utilizes a Pt-type cat, operating at *ca* 500 p.s.i. Charge naphthas—to produce low-S, high-octane motor fuels, with aromatics for petroleum chemicals and low-cost H_2 as valuable by-products—contain 0·01–0·15 wt % of S. The results presented represent corrosion tests on various steel types placed on test racks, at critical positions in 2 commercial Sovaformers. Plant and lab tests agree. H_2S corrosion produces FeS—especially in H_2-rich atmospheres—forming a little scale, which spalls off and interferes with normal unit operations,

ultimately causing plugging. A crust of FeS scale on the cat bed does not cause any appreciable pressure drop, but pressure drop is caused by finer powder sifting into the cat bed. A composite figure shows a schematic flow diagram of the Sovaformer, average temp during the test period at each rack location, and corrosion rates for 3 groups of steels graphically. C- and low-Cr-steels, *e.g.* 0·9% Cr steel, exhibit the poorest corrosion resistance. Cr–Ni stainless steels show good corrosion resistance, with 12%-Cr steel intermediate between the groups. An Al coating is an effective protection against steel scaling. A second series of experiments with a charge of low-S stock showed less total steel corrosion, but confirmed data concerning the relative merits of the various steels. R. T.

981. Non-destructive techniques in refinery inspection. P. W. Sherwood. *Corrosion Tech.*, 1957, **4** (5), 148–51.—Non-destructive testing techniques—originally developed for other needs—are being applied widely in the petroleum industry. Electric and magnetic methods involve measurement of capacitance, transformer efficiency, magnetic force, inductance, and resistance. Cracks are determined by a magnetic method. Radiography—revealing numerous faults in cast and wrought products, and welds—permits measurement at considerable depth. X-ray examination—standard in acceptance in the petroleum industry—derives its radiation from metal bombarded with electrons. γ-Rays are the spontaneous emanation of certain isotopes, *e.g.* cobalt 60 and iridium 192. The latter has the advantage of higher radiation output than radium or cobalt 60. The cobalt-60 isotope is a cheaper source of radiation than radium. Ultrasonic waves—typically generated by applying a.c. across a thickness of quartz plate—are typified by the fineness of determination and penetration depth possible. Inspection is possible on equipment in operation at 200° C, without shutdown. R. T.

982. Corrosion and cathodic protection. Pt 2. H. V. Beezley and G. R. Olson. *Petrol. Engr*, 1957, **29** (6), D28–34.—The most satisfactory method of corrosion control of pipelines is to apply a protective coating and then to use cathodic protection to prevent corrosion at any faults in the coating. The pipe is kept at a negative potential with respect to the soil, and leakage current is supplied by mains rectifiers or gas engine generators. Bare pipes may be protected by a series of rectifiers with an electrical power distribution line built along the pipeline to serve the units. Main savings effected by the use of cathodic protection are in increased pipe life and in cost of lost products. Additional savings are in leak repairs, damages, goodwill, and loss of revenue. E. A. G. H.

983. Three kinds of pipe protection are being applied on N.G.P.'s major project. R. Reed. *Oil Gas J.*, 9.12.57, **55** (49), 98.—Coal tar asphalt and plastic tape are being used on different sections of the Natural Gas Pipeline Co's 350-mile main lined from Bridgeport, Texas, to Fritch, Texas. G. A. C.

984. Polyethylene tape for pipeline production. P. Reed. *Oil Gas J.*, 30.12.57, **55** (52), 223.—Taping operations in the Natural Gas Pipeline Co's Bridgeport to Fritch, Texas, section is described; the pipe is welded and, after taping, holidays are spotted by a detector operating at 7500 V. G. A. C.

985. Statistical evaluation of oil tank bottom corrosion by sampling. — Meyer. *Rev. Inst. franç. Pétrole*, 1957, **12**, 834–63.—It was necessary to replace a 20-year-old riveted storage tank by a new welded tank, and estimation of the extra bottom thickness needed to counteract corrosion had to be carried out before the old tank was demolished. The corrosion of the bottom of the old tank was calc by statistical methods from measurements on sample borings taken at points selected statistically In an appendix the distributions of results are compared with those given by Laplace-Gauss and Galton, and a second appendix compares expt and theoretical results and results obtained by later examination of old tank bottom. In light of the latter results a larger No. of samples would have been taken, and a slightly greater overestimate of extra thickness required would have been made. W. A. M.

986. Review of low temperature corrosion from the combustion gases in oil burning plant. G. F. J. Murray. *Schweiz. Arch. angew. Wiss.*, 1957, **23**, 280–92.—Typical inspections of fuel oils on Swiss market are given (S 0·7–3·6%). Main corrosion source in flue gases is SO_3, content of which is *ca* 0·002–0·005%; increase in SO_3 causes rise in acid dew-point (a.d.p.), at which H_2SO_4 condenses. A.d.p. does not vary linearly with S content of fuel, and above *ca* 1% S (a.d.p. approx 125° C) every additional 1% S causes only *ca* 4° C rise in a.d.p. V content has no significant effect on a.d.p. % conversion of SO_2 to SO_3 falls with increasing S content of fuel, and is unaffected by form in which S is present therein. Main factor in formation of SO_3 is excess air, a.d.p. falls with increasing CO_2. Increase in flame temp favours SO_3 formation. A.d.p. can be depressed by addition of solid basic materials (*e.g.* Mg soaps), but most effective anti-corrosion method is NH_3 injection to combustion gases (at 230°–350° C), causing reaction with SO_3 but not with SO_2. Long discussion, in which results of MgO addition, and of corrosion tests on Fe with Mg, Ca, Ba, and ammonium sulphates are given (illustrations). V. B.

ENGINES AND AUTOMOTIVE EQUIPMENT

987. Gas turbines for motor cars. H. van Speybroek. *Ingenieur, 's Grav.*, 31.5.57, **69** (22), V47–5.—The development of the gas turbine as a prime mover in cars meets with some difficulties absent in aeroplane design. A survey is given of the different types of gas turbine to be considered for cars. The specific weight and performance of gas turbines and piston engines are compared. The fuel problem is discussed with regard to required properties, availability, and price. After a survey of the prototypes already developed, the future of the gas turbine for motor cars is predicted. 4 tables, 11 figs. G. F. T. C.

988. Supercharging large 2-cycle internal combustion engines. R. G. Bolfing and H. B. Emery. *Proc. 36th ann. Conv., nat. Gas Ass. Amer.*, 1957, 31–7.—The need for more gas compressor h.p. at an economical cost is a pressing problem in the natural gas industry. It is believed this is particularly so among the gas producers, since in many instances, due to circumstances beyond their control, an increase in gas compressor investment is not accompanied by an increase in ultimate revenue. First, before making an investment to increase gas handling capacity of a compressor station, the authors' company makes a thorough study to make sure that existing machinery is being operated at peak performance. Secondly, a study is made to determine the most economical way in which to increase compressor station engine capacity. This can be done either by installing additional compressor units or by supercharging existing units. Based on manufacturer's rating, the author's company has increased compressor engine capacity as much as 25% by supercharging

conventionally scavenged engines at a cost per b.h.p. of only 40% of original installation cost. However, based on field tests, max capabilities of these engines were found to have been increased as much as 50%. Using the 50% gain in gas b.h.p. over manufacturer's original rating, the cost of supercharging was only 31% of original installation cost. The authors feel that supercharging existing 2-cycle engine installations should be seriously considered by all who are confronted with the need for more h.p. This method of increasing engine output has been proved successful during many thousands of operating hours.
(Authors' abstract.)

989. Ranque vortex-tube combustion chamber. J. M. F. Vickers. *Nature, Lond.*, 1957, **180**, 1271.—The burner consists of a main tube (i.d. 1 inch) fed by a tangential nozzle of cross section 2·30 by 0·017 inches. Orifices of dia $\frac{5}{8}$, $\frac{1}{2}$, $\frac{3}{8}$, and $\frac{1}{4}$ inch are used, and the burner can also be run with both ends open and with the orifice end closed off. The types of combustion obtained under different conditions are briefly described. H. C. E.

990. Prevention of crankcase explosions. Anon. *Gas Oil Pwr*, 1957, **52**, 244.—It has been shown that crankcase explosions arise from ignition of oil mist by overheated pistons or bearings. The safety device employs photoelectric cells and operates by measuring the mist density obscuring the light from cells which are normally in electrical balance. It operates an audible warning when the oil concn in the mist reaches 2½% of the lower explosive concn at the working temp, and there is thus ample time to take remedial action. H. C. E.

SAFETY PRECAUTIONS

991. How to fight refinery fires. J. L. Risinger. *Petrol. Refin.*, 1957, **36** (12), 204–16.—Knowledge of the conditions under which petroleum and its products burn is the key to fire control. For fire-fighting purposes, petroleum and its products can be divided on the basis of vapour pressures and whether the oil is in motion or at rest in some container. This article discusses several methods of extinguishing both the contained and uncontained types of refinery fires. Both these types are divided into 2 classifications, namely, high and low flash point. The case of high flash point oil contaminated in error with low flash point oil is considered in some detail. The combination of a contained and uncontained fire is discussed, and methods of controlling LPG fires are also described. J. R. T.

992. What you should know about fires. J. L. Risinger. *Petrol. Refin.*, 1957, **36** (11), 369–74.—The basic principles of extinguishing fires are outlined under several headings, including knowledge of flammable range of material, determination of status of oil, and flammable *v.* combustible. Use of the fire triangle is described, and methods of reducing vapour and air vol are discussed. A classification of oil fires for the purpose of fire fighting training is also outlined. J. R. T.

993. Disaster planning special report. Anon. *Petrol. Refin.*, 1957, **36** (12), 102–20.—No matter how efficient the precautionary measures, disaster may strike any refinery at any moment without warning. Although it is economically and physically impossible to eliminate all disaster hazards, it is possible to prepare for disaster by advance planning. This special report provides suggestions for disaster planning applicable to both small and large operations. Particular emphasis is given to the 8 most vital areas of planning, namely, organization, responsibilities, procedures, training, mutual aid, communications, transportation, and public relations. The ideas offered in each of these areas are based on material provided by several large industrial organizations. J. R. T.

994. Air pollution in diesel bus garages. B. T. Commins, R. E. Waller, and P. J. Lawther. *Brit. J. industr. Med.*, 1957, **14**, 232–9.—Further tests at a garage previously investigated, and extension to a second garage, confirm the general pattern of interim findings in respect of polycyclic hydrocarbons (*cf.* Abs. **139**, 1957). Concn of NO_2 and aldehydes were found to be low and below threshold values adopted for exposure limits, that of CO was negligible, and there was no evidence of abnormal SO_2 concn. V. B.

995. How to control static electricity in commercial tankage. W. M. Bustin, T. L. Culbertson, and C. E. Schleckser. *Oil Gas J.*, 16.12.57, **55** (50), 89.—Safety measures include low pumping rates, avoidance of surface agitation and water, and use of floating-roof tanks to eliminate the vapour space. Tanker compartments should be gas-freed when necessary, and CO_2 blanketing used for some large operations. G. A. C.

MISCELLANEOUS

996. Predicting V–L equilibrium data. R. S. Schechter and M. van Winkle. *Petrol. Refin.*, 1957, **36** (9), 301–4.—Preliminary design of dist columns often necessitates computing vapour–liq equilibrium data for binary systems. This article presents a systematic method of computing vapour–liq equilibrium data from a single point of experimental data utilizing the Carlson and Colburn form of the van Laar equation. No trial-and-error is involved, and the technique is easily adaptable to machine computation. J. R. T.

997. Working pressure of tanks. D. S. Davis. *Petrol. Refin.*, 1957, **36** (10), 128.—A nomograph is presented which allows easy estimation of the working pressure of a hammer-welded steel tank from a knowledge of the i.d. and the shell thickness. J. R. T.

998. New ideas to make gaskets work. R. H. Koch. *Petrol. Refin.*, 1957, **36** (10), 131–4.—The overall performance of a gasket is dependent upon 3 basic, interrelated factors, namely, material, environment, and application. Each of these factors is considered in detail, and actual case histories are outlined to show how gasket and packing problems can be overcome to ensure continuous operation. J. R. T.

999. Your design reference file. VIII. R. Cushing. *Chem. Engng*, 1957, **64** (11), 257–64.—Notes on useful references on dist and dist column design, also on appropriate physical data, instrumentation and control, and operation of dist units. References on evaporation, absorption and adsorption, air pollution, dust collectors, cyclone and entrainment separators, filters, screens, and centrifugal separators are also given. P. J. O.

1000. Cost projector slide rule speeds estimate. Anon. *Oil Gas J.*, 23.12.57, **55** (51), 69.—This novel rule facilitates production of a cost estimate and shortens time spent in

reference work. It is based on the Nelson Cost Index of the *Oil Gas J.* G. A. C.

1001. International competition. An intermediate assessment. (In German.) Anon. *Chem. Ind.*, 1957, **9**, 589–680.—In a lengthy review of the economic position, mainly of Latin-American countries, reference is made to the oil and petroleum chemical industry. Reference is also made to the position of the Arab countries after the Suez crisis. P. J. K.

1002. Many applications for "Tube-in-Strip." Anon. *Pipes & Pipelines*, 1957, **1** (7), 23–4.—Newly developed tube-in-strip consists of a single strip, or sheet, of solid Cu, brass, or Al, in which tubes are inflated to desired running lengths in a variety of shapes or sizes. The product is suitable for petroleum processing, etc. R. T.

1003. Suez crisis reveals U.S. oil weaknesses. H. C. Rea. *Oil Forum*, 1957, **11**, 80–3.—The far-reaching effects of the Suez crisis comprise a re-appraisal of the entire economic systems of European countries. World trade routes have been changed. European capital is being transferred to the U.S.A. and Canada. The European common market is almost an accomplished fact. Economic implications of a European Customs Union—holding the balance of power of world trade—will influence international energy control. The U.S.A. and U.S.S.R. world-dominating ideologies are not compatible to European thinking. OEEC states that Europe is accelerating discussion of a nuclear energy pool for industrial power. OEEC forecasts a 53% rise in Europe's oil consumption by 1960. This rising energy demand cannot be met by Europe's coal production. The Suez Canal *per se*—for physical and economic reasons—cannot continue to meet Europe's increased demands indefinitely, and will probably pass gradually into history. If the Middle East is to continue as the main source of Europe's energy, transport facilities must be expanded, and political stability in transport countries is essential. Transatlantic pipelines from Canada to England and lines from Tanganyika to SW. Africa, etc., are visualized. Serious consideration is being given by European private capital to enter the exploration and development field for new oil reserves in Venezuela, the Caribbean areas, the Persian Gulf, etc. The political and economic situation in the Middle East confronts the U.S.A. with a complex and competitive problem. Uncertainty arises regarding the position of the U.S. oil industry, in which weak spots have been revealed during 2 wars. Sufficient oil exists, but incentive to find it is running out under the present politico-economic system. R. T.

1004. How an inexpensive research programme can be started. Anon. *Oil Forum*, 1957, **11**, 87–9.—Cost of tech research—profitable through new product development—is beyond some small refiners' means. Assistance is given in establishing a research ref library, by giving data on sources of relevant ref materials on past and current research activities, at low cost. R. T.

1005. Price wars harmful to the industry. M. L. Freese. *Oil Forum*, 1957, **11**, 114.—Marketing methods of many oil companies are criticized severely. Disregard of product quality and prestige built up by advertising are condemned. Too much authority is given to sales departments, who sell their merchandise at any rumoured price obtained by competitors. R. T.

1006. We do not start price wars. J. G. Jordan. *Oil Forum*, 1957, **11**, 116.—In testifying before Senator Kefauver's Anti-trust and Monopoly Sub-committee, J. G. Jordan stated that price wars result from hot competition among local-brand competitors. This places the Shell dealer in an uncomfortable position. If S11—ending price assistance—be adopted, Shell sees no way to assist its dealers to meet the price competition of cut-rate chains, without being charged with substantially lessening competition. R. T.

1007. Possible solution to import problem. T. O. Lisle. *Oil Forum*, 1957, **11**, 117.—Conflicting opinions on the vol of U.S. oil imports are discussed. A proposal is advanced that the Government purchase—at market rates/brl of oil—all domestic fields, and store the oil for national emergencies. An increase in oil import duty could be an additional factor to encourage independent exploration. R. T.

1008. Scientific manpower shortage? W. F. Libby. *Oil Forum*, 1957, **11**, 118–19.—The author deals specifically with manpower shortage in the science and engineering of nuclear phenomena. This applies equally to other spheres, *e.g.* petroleum technology. Important relevant facts are poor pay of high-school teachers, engineers, and scientists, and the hard tech life. Solutions are discussed, which apply equally to the instruction of embryo petroleum researchers and technologists. Oil company executives could encourage their leading scientists to co-operate with presidents of nearby universities, to make themselves available for part-time teaching. R. T.

1009. Snakes alive! or how pipeliners can stay that way. Anon. *Pipe Line Ind.*, 1957, **6** (4), 54.—Instructions are given for avoiding snakes, and first-aid treatment for bites affecting pipelining personnel. R. T.

1010. Use of large electronic assemblies in the petroleum industry. — Dreyfus and — Le Garff. *Bull. Ass. franç. Tech. Pétrole*, 1957, 447–60.—Following on short general outline of principles and functions of computers and data processing equipment, indications of their application to the petroleum industry, for calculations and operational research, in fields of prospecting, drilling and production, transportation and refining, distribution and marketing, are given. V. B.

1011. Calculate heater tube temperatures. A. Doll-Steinberg. *Petrol. Refin.*, 1957, **36** (12), 165–9.—A means of estimating max tube-wall temp is essential for the design of a fired heater and for specifying alternate operating conditions for existing heaters. A method for the calculation of this max temp is presented. The analysis accounts for variation of radiant heat flux around the circumference of a tube and the circumferential heat transfer in the tube wall from the hotter to the cooler points to obtain the max tube-wall temp. J. R. T.

1012. Which depreciation method is best? B. J. Gaffney. *Petrol. Refin.*, 1957, **36** (12), 137–46.—The generalized mechanics and limitations of depreciation calculations are presented. Equations for the generally accepted depreciation methods are developed, and a new equation incorporating a declining balance principle is derived. This new method, called "Sum of Percentages," would, if adopted, permit faster write-offs. The profit statistics of industry are briefly discussed and different concepts of depreciation effects in project evaluations presented. The effect of inflation on replacement is also considered. J. R. T.

1013. Recent developments in fluid flow. R. C. Binder. *Petrol. Refin.*, 1957, **36** (12), 125–9.—A review of the significant trends and progress in fluid mechanics is presented. The analogy between fluid friction, heat transfer, and mass transfer is considered and the various types of fluid flow described. Several other topics, including high speed flow, noise, combustion, atomization, and rarefied gas dynamics are considered. The article is presented in as non-technical

a manner as possible, without the use of equations or derivations. J. R. T.

1014. Thermo data for petrochemicals. K. A. Kobe and D. H. Kobe. *Petrol. Refin.*, 1957, **36** (12), 147–8.—Use of a 4-point Lagrangian interpolation formula enables easy calculation of thermodynamic data for intermediate pressures from values given in the literature. This formula can be used when the pressure intervals are irregular. A table is presented showing the approx max % deviations between values calculated by the 4-point formula and by linear interpolation. J. R. T.

1015. Impact of Western oil and gas on the Canadian economy. C. O. Nickle. *Engng J., Montreal*, 1957, **40**, 1283–7.—In terms of new capital invested, new employment created, breadth of impact on the national economy, and degree of changeover of a vast section of Canada to a diversified economy, W. oil can be classed as the most important of the decade's resource developments of the country. Though the oil administration needs provided the foundation, Calgary has developed various industries, catering for its own and Alberta's expanding population. The Imperial–Leduc discovery in 1947 began an era of international interest in W. Canadian oil. Other discoveries, *e.g.* Turner Valley field and Pembina, are discussed. The vast number of oil or gas fields is being increased by 100 or more p.a.; productive wells number 12,000, which is increased now by over 2500 p.a. In a decade production has increased to 30 times the 1947 level. Gross revenue from oil production—only $16 million/p.a. a decade ago—was $400 million in 1956. Pipelines play an important part. To-day the pipeline network, *ca* 6000 miles, represents a $600 million investment. The Gordon Commission suggests a possible level of production to meet Canadian demands in 1980. Potential output of oil in 1980 is estimated at *ca* 10 times 1955 production, and from 1·5 times to twice the anticipated Canadian requirements of 1980. For gas potential output is estimated at >15 times 1955 output or 50% $>$ expected domestic requirements in 1980. The outlook is rosy. R. T.

1016. India's difficult phase. Anon. *Petrol. Press Serv.*, 1957, **24**, 440–2.—Supreme importance—in troubled Asia—attaches to the course of affairs in India. Hopes are centred on the Five-Year Plan for economic development. However, the Plan is retarded because sufficient foreign exchange is not available, in spite of help from the W. and the U.S.S.R. Industrialization will increase India's need of commercial energy, and a bolder approach must be made to the whole subject of oil exploration and development. So far, of commercial energy coal supplies 80%, petroleum products 14%, and water most of the remainder. Alternative fuel is required for the countryside to avoid fertilizer loss through burning animal dung. Inland oil demand should rise substantially above the present level of 5¼ million tons/year. Production, now 400,000 tons/year, could rise to *ca* 3 million tons, if agreement could be reached between the Government and Assam Oil on development of the areas discovered recently at Nahorkatiya and Hugrijan. Exploration is being carried on in various districts by the Government and by Indo-Stanvac with Government participation. More extensive exploration is required, and suspicion of India's intentions must be removed to encourage the oil explorer. R. T.

1017. Development of Soviet oil industry in 1956. L. Tomaszkiewicz. *Nafta (Krakow)*, 1957, **13**, 163–6.—In the first year of the sixth 5-year plan, the Soviet fields yielded 84 million tons, 2% more than planned for, and 12·9 million tons more than in 1955. 72% of this oil came from the E. regions (Bashkiria, Tartary, and Kuybishev), which in 1955 gave 68·1% of total production. New production methods gave 20% of the total (14 million tons in 1955). Water flooding was used very extensively, and there was a 47-fold increase since 1946 when 7000 cu. m/day of water were pumped in, and as a result the proportion of oil from self-producing wells rose from 23% in 1940 to 63·3% in 1956. Similarly, 64% of oil won came from treated wells, and in 1957 this figure will reach 68%. New methods are being devised, and will be tried out in Bashkiria. In connexion with this trend better instruments for estimating well bottom pressure are being perfected. A pump delivering water at 120–200 atm, 150 cu. m/hr is being used. Future work includes surface active agents, thermal action, gas repressurizing, and a project to lower the pressure in the formation so that gas forms inside the rock and displaces oil. Progress in well shooting is directed towards plastic, copper foil, and aluminium cartridges. By the end of 1956, 500 new well bottom electric pumps were in operation. Automatization and centrally operated pumping units were introduced in particular to those wells which were low producers. New oil and gas bearing regions were discovered in the Volga–Ural district and near Kuybishev. Others in S. Ishimbey, in Turkmania, and Azerbeidjan (gas) must be mentioned, whilst work is progressing in the Volga basin, Siberia, and the Far East. In W. Siberia and near Yakutsk new gas fields have been located. Shortcomings in the search for oil have been the subject of 2 conferences. Less success has been registered in drilling, which has impeded oil production. Practically no progress has been registered, and the number of wells drilled was the same in 1956 as in 1954, whilst the number of rigs in good repair fell from 1220 to 740. Also instead of 1100 m/rig/month, only 946 m/rig/month has been reached in drilling in recognized fields. Over 85% of all the drilling was done using turbo-drill, and 2 out of 3 are done at a forced pace. In Azerbeidjan 4832 m depth was reached. Branched wells were drilled in some cases, and mechanical improvements were registered. The slow rate of progress was due to frequent and long stoppages also to shortages of steel and equipment. Better steels for drilling bits are to be available in 1957. There has been a shortage of drilling mud, pipe, spares, and other items, such as housing, etc. With several projects not completed or ever likely to be, costs are too high. Total for 1957 is likely to reach 5665 m, but the primary objective for that year is greater productivity. In refining, the U.S.S.R. has increased its production by 18% over 1955 and 14% in cracking (40% in cat cracking). Production of oils rose by 25%, white products by 20%, motor spirit by 24·9%, and diesel fuel by 32·2%. 47 million tons were delivered by pipeline or by river barges and pipelines. 3 pipelines are to be completed in 1957: Almetovo–Gorki, Almetovo–Molotov, and Zhirnoye–Stalingrad (for crudes), as well as Kurgan–Kaybarog double line for motor spirit and diesel fuel. In all a 20% increase is anticipated for 1957. M. S.

1018. Rumanian petroleum industry. W. Kisielow. *Nafta (Krakow)*, 1957, **13**, 159–62.—There are 4 oil centres in Rumania: Ploesti, Buzau, Moinesti, and Oltenii. Production in 1955 was 10·6 million tons, in 1956 10·9 million tons, and for 1960 the aim is 13·5 million. In refining, activity is directed towards expansion in such a way as to be able to refine raw materials suitable for cracking and towards introduction of dewaxing. Technical education is given at Institul de Petrol si Gaze, the Rumanian Oil Polytechnic, in Bucharest, with 4 departments: technical, equipment, exploitation (production), and economic. Study in the first leading to a diploma, takes 4 years and 10 months, of which 16 weeks is spent at a refinery. Final diploma thesis has to be "defended." Present studies are aimed to contribute towards solving Rumania's problems involved in the introduction of cat cracking. The chemical section, under Drs J. Creanga and V. Vintu deals with properties of pure hydro-

carbons, and work on their adjuncts with urea is done by the latter. This school, the Investigation Institute, Bucharest, Central Laboratories, Ploesti, and Project Institute, Ploesti, are all under the Ministry of Petroleum Industry. Their work is as follows: (1) technology and drilling; (2) crudes, raw materials, and processing; (3) technological and drilling projects. Refinery No. 1, located in Ploesti, capacity nearly 4 million tons p.a., produces a full range of fuels and oils from crudes of asphaltic base using atm and vacuum dist, from which lubricants are produced by H_2SO_4 and by deasphalting. Residues from paraffinic crudes are cracked. Other products from this refinery are L.P.G., " Paragel " additive, and a range of naphthenic acids. No. 3 refinery, the expansion of which is nearly completed, is in Teleajen. It is concerned with cracking paraffinic residues to produce high grade petrol. The new section is equipped with some Soviet engineered units. Refinery No. 9 at Braszow uses as its feed dist from Campin and other refineries. Its main work is refining with furfurol, benzene with acetone, petroleum ethers and supplementary acid refining. Furfural, obtained from sunflower seed husks, is recovered by 2-stage dist with methane. This refinery produces ceresine. The most modern refinery in Rumania is No. 8 at Dermaneszti, which was started in 1949 and completed in July 1956. The crude is low-paraffin oil but of high S content (0·5–0·7%) from Moldavia province. It is dist and cracked. 3 dist units are operating: McCee type, a Czech-built unit, and a Rumanian-designed unit. Desalting equipment is Soviet, and so is the thermal cracking section. Cracked gasoline is only lightly treated, and will soon be stabilized with locally-made additive. Drilling in Rumania is done by means of turbo-drill, and exploratory work is going on near Bucharest. M. S.

BOOK REVIEW

Joint Conference on Combustion. London: Institution of Mechanical Engineers, 1957.

The proceedings of the Joint Conference on Combustion held in Boston, Massachusetts, in June 1955, and repeated in London in October of the same year, are assembled and published in a single volume. Several review articles on the fundamentals of combustion form an excellent introduction to the subject. The 42 papers presented cover combustion technology in the field of boilers, industrial furnaces, internal combustion engines, and gas turbines.

The section on combustion in boilers deals with a critical examination of flame failure detection equipment; methods for disposal of petroleum refinery waste gases; various methods of firing including an interesting contribution from Germany on the development of cyclone firing of wet-bottomed furnaces, and two papers on the use of pulverized fuel.

In the industrial furnace section, papers were included on the design of oil burners for open hearth furnaces and a theoretical treatment of heat transfer problems in open hearths was also discussed. German development in cupola combustion was also the subject of two further papers. A contribution on a surface process using high temperature gaseous jets in applications such as submerged combustion, singeing of textiles, glass polishing, etc., pointed the need for more knowledge on high temperature aerodynamics in order to stimulate advances in this field.

The development of high compression turbo-charged spark ignition gas engines for increasing pipeline power requirements in the U.S.A. is the subject of the first paper in the section on internal combustion engines. Particular interest is in the use of turbo-charging for two-cycle engines, which is described. Results of basic surface ignition studies in a motored engine were explained in terms of a simple model. This paper and its successor, a study on combustion products and wear in high-speed compression ignition engines at BICERA, promoted considerable discussion, which is reported in full. The latter paper is of particular interest in connexion with the problem of burning low grade fuels. Large modern diesel engines are also reviewed and their combustion characteristics discussed. Combustion in petrol engines and dual fuel engines also received coverage.

In the section on gas turbines two papers were devoted to methods of recording temperature and movement of flames. A paper on the maximum heat release rates for hydrocarbons showed this factor to be limited by the rate of CO burning. Large-scale gas turbine applications, the use of both coal and blast furnace gas firing, and general operating experience in turbine equipment form the subject of eight papers.

The volume is characterized by the space given to the reporting of discussions at the meetings, and this makes it extremely valuable, since it is very often in the discussion sections themselves that some of the more interesting and important points are raised. From the papers presented, there is evidence that the gap between fundamental research and its application to technology is still large, but some of the papers genuinely try to bridge this gap. If one may single out one contribution, the paper on chemical and physical factors controlling the rate of combustion, by Professor O. A. Saunders and Dr D. B. Spalding, deserves special mention.

Besides being a report of an important meeting the review nature of many of the papers contained in this volume makes it a valuable addition for reference purposes both for the research worker in enabling him to orientate himself correctly to the practical problems to which his research is ultimately devoted, and also giving a useful theoretical background which can be of assistance to the practical engineer. M. F. H.

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1019. Stratigraphy of Comanchean Cretaceous Trinity group. J. M. Forgotson. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2328–63.—The purpose of this paper is to combine information obtained from surface studies with the wealth of subsurface information to form a continuous and coherent picture of the stratigraphic relationships within a defined group of rocks. An attempt is made to show the age equivalency of selected rock units, as well as the regional facies changes of time-rock units, by defining the selected intervals with time-parallel surfaces. E. N. T.

1020. Effect of overburden and reservoir pressure on electric logging formation factor. I. Fatt. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2456–66.—Electrical resistance of 21 brine-saturated reservoir sandstones was measured at various internal and external pressures. The resistance, and therefore the electric logging formation factor, increased with increase in the difference between the external and internal pressure. The exponents and coeff in the Archie and Winsauer relations between formation factor and porosity were found to be functions of this difference in pressure. For a given sandstone, formation factor increases more rapidly with decrease in porosity during compression than would be expected from the average line through the formation factor *v.* porosity data for the 21 core samples. E. N. T.

1021. Base-level control patterns in cyclothemic sedimentation. H. E. Wheeler and H. H. Murray. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1985–2011.—No attempt is made here to add still another to the several rather exhaustive and comprehensive reviews of the voluminous literature pertaining to cyclothems. Instead, a critical analysis of the salient arguments presented by the principal proponents of these 2 theories is attempted from the viewpoint of their validity on the basis of the stratigraphic principles involved—particularly the all-important Barrellian principle of base-level. In addition, on the conclusion that neither of these theories adequately accounts for all essential cyclothemic relationships, and on arriving at the interpretation that an ideal cyclothem manifests 4 base-level phases, rather than 2, the Simpson glacial theory, with its 4 eustatic phases, is " tried for size."

The Simpson theory seems to fulfil the demands of the stratigraphic relations, which, if true, tend to both strengthen this theory and indicate the validity of its application to late Palæozoic cyclic sedimentation. Thus the conclusions derived here do not embody an entirely new theory of cyclothemic genesis, but a modification of the Wanless–Shepard glacial control theory. E. N. T.

1022. Texture as characteristic of clastic deposition. R. Passega. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1952–84.—This paper is an attempt to establish relationships between texture of sediments and processes of deposition, rather than between texture and environments as a whole. The texture is defined by parameters, the choice of which was guided by an analysis of transportation processes. The parameters of a group of samples of a depositional environment, plotted on a graph, define sample points. As numerous examples show, the distribution of these points is closely related to the depositional processes. Patterns formed by the sample points characterize by their shape and arrangement of points the principal depositional agents. E. N. T.

1023. Porphyrin research and origin of petroleum. H. N. Dunning and J. W. Moore. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2403–12.—The importance of porphyrins has only recently been generally recognized in the petroleum industry and an intensive research programme carried out at the Petroleum Experimental Station, U.S. Bureau of Mines, has resulted in an accumulation of considerable information on the properties of these natural pigments and their effects on the exploration, production, and refining of petroleum.

The results of porphyrin research have several important implications on the geochemistry of petroleum. The widespread occurrence of porphyrins in bituminous materials is evidence of their biological origin. The carboxylated porphyrin contents of some crude oils indicate that these oils, and presumably others, have a low-temp history. Correlations of porphyrin studies indicate that the common nickel- and vanadium–porphyrin complexes are formed by metal exchange reactions with animal and plant metabolic pigments, such as hæmoglobin and chlorophyll, which were present during the early stages of petroleum formation. Porphyrin studies offer considerable support for the current theories that petroleum is formed slowly in marine or brackish environments from marine and terrestrial plant and animal matter and that the asphaltic constituents of crude oils are of primary formation. During the evolution of the oil these simplify to form the clean, paraffinic oils commonly associated with older formations. E. N. T.

1024. " Structural correction " for gravity maps. J. W. Phillips. *Petrol. Engr*, 1957, **29** (7), B35–40.—Geological structures may now be interpreted from gravity data using a new electronic analogue computer developed for quantitative gravity analysis. A new technique computes the isolated effect of known structures, subtracts the results from the observed gravity, and may reveal low order anomalies. The computer uses light flux as an analogue of gravitational flux, enabling the " structural corrections " to be calculated rapidly. E. A. G. H.

1025. Prospecting on the bottom. R. Tregaskis. *API Quart*, 1957, Autumn, 26–31.—Conventional methods used on land to estimate underlying rock structures by studying surface outcrops cannot be applied in coastal waters. The Brunton compass used on land is too complex for underwater prospecting. Using an aqualung and improvised equipment suitable for underwater work, G.D.C. (Geological Diving Consultants) succeeded in mapping the underwater rock structures off the Santa Barbara shore for the U.S. Navy. How G.D.C. succeeded in locating oil, *e.g.* the " island " of oil off the San Pedro breakwater, is described. R. T.

1026. New York's geology. W. L. Kreidler. *Oil Gas J.*, 7.10.57, **55** (40), 228.—The regional geology of New York State is described. Oil and gas fields have been found in the N. part of the Allegheny synclinorium, and the oil-producing formations are in the Upper Devonian Canadaway group. The gas pays are mainly the Oriskany and Medina sandstones in the W. and the Trenton limestone in the central part of the state. Smaller production has been obtained from the Potsdam sand and various Devonian beds. The stratigraphy and lithology of these formations are discussed, together with the nature of the accumulations, the gas in the Oriskany, for example, being largely controlled by anticlinal structures. Areas which are favourable for future exploration are noted. A diagram shows the surface geology of the state. C. A. F.

1027. Structural elements of Northeastern Appalachians. H. P. Woodward. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1429–40.—The geographic area discussed in this report is the NE. corner of the Appalachian basin in E. Pennsylvania and SE. New York.

The writer takes issue with various aspects of the orthodox structural explanation of this area and advocates a new look and a very different hypothesis on the basis of preliminary field studies. E. N. T.

1028. Palæoecology of nodulose zone at top of Haskell limestone (Upper Pennsylvanian) in Kansas. H. W. Miller and A. Swineford. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2012–36.—The purpose of this investigation was to make a palæoecological study of a section of Pennsylvanian rocks one ft in thickness, and to describe phosphatic nodules contained in it. The problem was treated by several methods. Fossils were collected and identified, no fossil group present being neglected.

The stratigraphic section studied has a total thickness of one ft and consists (in upward order) of a lower marine shale with phosphatic nodules at the base, a goethite bed, and an upper shale bed. The lower marine shale contains typical corals, brachiopods, and bryozoans and was deposited in an oxidizing environment. Seemingly the lower marine shale marks the beginning of a new cycle of deposition, with the upper shale bed of the one-ft section deposited in brackish water. The short-lived environment of the lower shale did not produce a typical marine assemblage of clay minerals. E. N. T.

1029. Devonian section at Bowmanstown, Pennsylvania. B. Willard. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2298–311.—Along the recently constructed N.–S. turnpike crossing SE. Carbon County, Pennsylvania, extensive cuts through ridges exposed Devonian strata. The beds strike about E.–W. At the S. end of a section W. of Bowmanstown, the oldest stand vertical. The dip of later beds, northward, flattens to nearly horizontal. An almost complete sequence was exposed from the Lower Devonian, New Scotland formation, into the Catskill continental redbeds. Not only were the formations completely excavated, but their contacts were cleared. Most thicknesses were measured directly. The section is strategically located, because it showed relationships between others E. and W. and illustrated facies changes along the strike. Much of the section is no longer available for study. E. N. T.

1030. Lower Ordovician (Beekmantown) succession in Berks County, Pennsylvania. J. P. Hobson, Jr. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2710–22.—The present paper is a preliminary summary of the Beekmantown succession established by the writer in Berks County, Pennsylvania. In the Reading Quadrangle, near the Schuylkill River, 4 mappable rock formations could be differentiated readily in the Beekmantown limestone, thus raising the name Beekmantown to the rank of group in that area. This paper summarizes the diagnostic rock characters of the units at the chosen type sections and introduces new names for 3 of the formations. E. N. T.

1031. Chronology of Appalachian folding. H. P. Woodward. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2312–27.—This discussion briefly covers the sedimentary, structural, igneous, and metamorphic records of Appalachian folding. It attempts to examine the chronology of the folding more fully than is usually done, and a subsequent paper is planned to interpret the conclusions in their bearing upon the economic development of the mineral and oil resources of this area. E. N. T.

1032. Environmental studies of carboniferous sediments. Pt I. Geochemical criteria for differentiating marine from fresh-water shales. E. T. Degens *et al.* *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2427–55.—Environmental studies of sediments are used for palæogeographic reconstructions which are finding increasing application in petroleum geology. The purpose of the present investigation was to determine to what extent marine, brackish-, and fresh-water shales can be differentiated by chemical and petrographic techniques. The Pennsylvanian strata of the Appalachian coal basin in Pennsylvania provide exceptional opportunities for environmental studies because of the alternation of marine and fresh-water sediments.

The investigation involved a study of the trace elements and clay mineralogy of 75 shale samples collected from the Allegheny cycles of the N. part of the Appalachian coal basin. All samples were analysed for boron, gallium, and rubidium; 59 were examined by X-ray diffraction for illite, kaolinite, and chlorite; 33 were analysed for the common trace elements; and 10 for the trace-element content of the ash of organic material mechanically separated from the shales. Sandstones, underclays, limestones, and coals, the rocks associated with the shales, were not analysed but will receive attention in a forthcoming study. E. N. T.

1033. Shelf-edge calcareous prominences in Northeastern Gulf of Mexico. J. C. Ludwick and W. R. Walton. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2054–101.—In the area of the NW. Gulf of Mexico off the coasts of Texas and Louisiana, there are 3 major classes of sea-floor protuberances which are divisible on the basis of relief, water depth, and distance offshore. The first class may overlie salt domes, and the second class have been interpreted as either salt domes, reefs, or calcareous banks. In the NE. Gulf of Mexico, features similar to this second class have been found near the edge of the Continental shelf between 40 and 55 fathoms. The zone of these prominences is approx. one mile wide, and the average relief of the pinnacles is 30 ft.

A detailed study of a limited area showed that the sedimentary and faunal characteristics of the deposits form natural groupings that can be correlated with submarine topography and the history of the region. E. N. T.

1034. Basal Claiborne of Texas, record of Appalachian tectonism during Eocene. T. W. Todd and R. L. Folk. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2545–66.—The Carrizo formation and the superjacent Newby member of the Reklaw formation (Eocene, Claiborne group) are lithologically similar sandstone units which crop out in Bastrop County, Central Texas.

On the basis of this study, augmented by petrographic examination of scattered samples throughout the rest of Texas Eocene sediments, a large-scale uplift of the S. Appalachian area is believed to have begun during the Midway or Sabine age and culminated during deposition of the great volume of upper Wilcox and lower Claiborne sediments in the W. Gulf Coast. E. N. T.

1035. Peripheral faulting at Bayou Blue salt dome, Iberville Parish, Louisiana. W. R. Mais. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1915–51.—The purpose of this paper is to supplement an earlier study (1938) on the history of development and the subsurface structure of the Bayou Blue salt dome in Louisiana 17 miles SW. of Baton Rouge. This dome was originally located in 1926 by a refraction seismic survey, and first production was established in 1929 at a depth of 1928 ft. The initial productive area on the apex of the dome, which gave oil from Pliocene and Miocene sands, was considered depleted in 1932. Further exploration resulted in production from Miocene sands on the W. flank in 1940, and subsequently deeper but non-commercial oil deposits have also been discovered on the NE. flank.

The dome is elliptical in outline and is characterized by peripheral faulting, which generally parallels the elongate axis of the dome. These faults, which are downthrown away from the salt plug, change direction, producing an arcuate or sinuous trace on any particular datum. They may join the salt face with depth or along strike of the salt mass. The domi-

nant peripheral fault of Bayou Blue offsets lowermost Miocene beds, which are present on the apex of the dome, to a position 4600 ft structurally lower on the NW. flank of the dome. The major producing area of the structure is located SW. of the dome's crest on the downthrown side of this peripheral fault zone in beds of Miocene age which terminate abruptly against the steep salt face. A system of complex radial and complementary faulting is present in the shallow beds above the apex of the plug. E. N. T.

1036. Some offshore exploratory problems. I. H. Cram. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1422–8.—When in 1944 operations were begun in the offshore areas of Louisiana in the Gulf of Mexico, it was a development that was the logical outcome of an increasing demand for petroleum products coupled with a relative shortage of new production prospects on dry land.

The author points out that the area off the coasts of Louisiana and Texas out to the edge of the Continental shelf is actually little larger than the Gulf Coast producing province while actually being part of the same geological entity. It is, therefore, not surprising that exploration of the offshore, using over 50 years of onshore experience, has resulted in such an outstanding discovery record. E. N. T.

1037. Minor internal structures of some recent unconsolidated sediments. D. G. Moore and P. C. Scruton. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2723–51.—Project 51 of the API for the study of recent continental shelf and near-shore marine sediments in the N. Gulf of Mexico has been carried out since 1951, principally on the E. side of the Mississippi River delta and in the region of the Central Texas coast near Rockport.

More than 2000 sediment samples have been collected and examined, and one of the purposes of this paper is to describe the minor internal structures that occur in shallow water deposits of the Gulf of Mexico and to discuss their distributions and origins. In addition, study of these sedimentary features has shown that their type and character are closely related to the sedimentary environments in which they are formed. E. N. T.

1038. Early Palæozoic strata in southeastern Arizona. R. C. Epis and C. M. Gilbert. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2223–42.—Limestone containing Lower Ordovician cephalopods and gastropods occurs in most of the exposed sections of early Palæozoic rocks E. of Sulphur Spring Valley, Arizona. Both the fauna and the lithologic character of this limestone identify it with the El Paso limestone of SW. New Mexico. It grades downward into Upper Cambrian sandy dolomite and dolomitic quartz sandstone which, in turn, overlie Abrigo limestone in the N. Swisshelm Mountains and at Black Gap (Bisbee District), Arizona. These relationships and the regional correlations suggested by them indicate that the Bolsa quartzite and Abrigo limestone in Arizona and the Bliss sandstone and El Paso limestone, respectively, in New Mexico should no longer be regarded as lithogenetic equivalents. E. N. T.

1039. Upper Devonian Swisshelm formation of Southeastern Arizona. R. C. Epis, C. M. Gilbert, and R. L. Langenheim. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2243–56.—The area of primary concern in this paper, the Swisshelm and Pedregosa Mountains, SE. Cochise County, Arizona, is critical in the regional stratigraphy of Devonian rocks, for it stands between a western facies of sandy and silty limestone and dolomite, the Martin limestone, and an eastern shaly facies, the Percha shale, Sly Gap formation, and associated rocks. Lithologically, the Devonian strata in the Swisshelm and Pedregosa Mountains are not closely comparable with either the western or the eastern facies, differing in the predominance of sandstone and siltstone over carbonate rocks and shale. Faunally, however, they have considerable similarity with strata of the other facies. All have been assigned to the Upper Devonian, and they probably overlap in age. Indeed, the Swisshelm and Pedregosa strata may provide the link necessary for close biostratigraphic comparison of the eastern and western lithofacies. E. N. T.

1040. Petrology of Beaver Lodge Madison limestone reservoir, North Dakota. D. Towse. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2493–507.—The Mississippian Madison limestone reservoir rock in the Beaver Lodge field, Williams County, N. Dakota, was studied to determine its lithologic character and distribution of the porous zones.

The reservoir is a fine- to medium-grained fragmental limestone and dolomitic limestone. Grains include fossil fragments, crystal fragments, and fecal pellets. Originally, porosity was intergranular, but later it was increased by solution and dolomitization and decreased by recrystallization and cementation. E. N. T.

1041. New developments on age and extent of Ouray limestone. R. L. Knight and D. L. Baars. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2275–83.—The Ouray limestone extends from the surface in the San Juan Mountains of Colorado into the subsurface of much of the Colorado Plateau Province. Previous lithologic correlations have been verified by a study of the fauna of a cored interval in the Hovenweep No. 1, San Juan County, Utah. This fauna contains *Paurorhyncha sp.* and *Cyrtospirifer whitneyi cf. animasensis*, verifying the lithologic and mechanical log correlation with the Ouray limestone outcrops.

In as much as the typical Ouray limestone fauna has both Mississippian and Devonian aspects and the formation contacts are gradational, the writers suggest that the unit is transitional between the Upper Devonian, Elbert formation, and the Lower Mississippian, Leadville limestone. E. N. T.

1042. Contact of Burro Canyon formation with Dakota sandstone, Slick Rock district, Colorado, and correlation of Burro Canyon formation. G. C. Simmons. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2519–29.—This paper discusses the contact of the Burro Canyon formation with the Dakota sandstone in the Slick Rock district, W. San Miguel and Dolores Counties, Colorado, with special attention given to its unusual nature in the structural basin underlying the NW. end of Disappointment Valley. In addition, fossil evidence is presented that substantiates the correlation of the Burro Canyon formation with the Cedar Mountain formation. E. N. T.

1043. Tectonics of eastern flank and foothills of Front Range, Colorado. C. M. Boos and M. F. Boos. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2603–76.—The Front Range, easternmost one of the Southern Rocky Mountain system, extends S. through Central Colorado from the Colorado–Wyoming state line to Arkansas River. It is *ca* 185 miles long and 25–45 miles wide.

15 structural units within the E. foothills belt and associated pre-Cambrian formations are described. The distinctive units are the result of strong horizontal compression from E. to W. during subsidence and under-thrusting of the bordering basins in Laramide time, compensating uplift of the body of the Range, and minor deformation of the more plastic foothills formations. E. N. T.

1044. Ignacio quartzite of Southwestern Colorado. F. H. T. Rhodes and J. H. Fisher. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2508–18.—This paper is a preliminary report on the age and stratigraphic relations of the Ignacio quartzite in the Animas River Valley, SW. Colorado.

The Animas Valley is located in SW. Colorado on the S. flank of the San Juan Mountains. The upper part of the

valley trends N.–S. and exposes a section of strata ranging in age from pre-Cambrian to Tertiary. These strata dip gently S. into the San Juan Basin. E. N. T.

1045. Reflection of possible deep structures by Traverse group facies changes in Western Michigan. R. L. Jodry. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2677–94.—Lithologic studies of the Traverse group in the Michigan basin have indicated that a large area of W. Michigan was isolated from the main sea during Traverse deposition. A W. Michigan barrier and resulting W. Michigan lagoon can be traced over a large area. The W. Michigan barrier shows relation to a pre-Devonian pattern of folding, and this deep tectonic pattern is coincident with the regional gravity of the area. In the W. Michigan area it appears possible to trace deep folding by lithologic studies of shallow beds where these folds are no longer apparent. The use of lithologic, facies, and sedimentation studies of shallow beds, combined with regional gravity studies, can furnish clues to the tectonic fabric of deeper beds where no direct information is available. E. N. T.

1046. Breccia and small-scale Lower Pennsylvanian overthrusting in Southern Illinois. P. E. Potter. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2695–709.—2 unusual exposures of Pennsylvanian sediments occur adjacent to a tunnel along the Illinois Central Railroad in NW. Pope County, Illinois.

These exposures show that slide structures of appreciable magnitude are not limited to argillaceous sandstone sequences of major geosynclines, but can also occur locally in the relatively clean sandstone sequences of intracratonic basins. E. N. T.

1047. Springer tries again. J. C. McCaslin. *Oil Gas J.*, 7.10.57, **55** (40), 227.—A new Pennsylvanian Springer sand discovery is reported from Beckham County in the Anadarko basin area of S. Oklahoma. The well is a few miles SW. of the Elk City field and flowed 21,000 M.c.f. gas/day and 400 brl dist from *ca* 10,200 ft. The accumulation is thought to be a stratigraphic trap against the basal Pennsylvanian unconformity, where beds are steeply dipping. Oil in the Springer was first found in 1944, and has since been found productive in many fields in the Ardmore and Anadarko basins. Future prospects of the Springer in the area are good. C. A. F.

1048. Mississippian bioherms in Northeast Oklahoma. J. W. Harbaugh. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2530–44. —The bioherms are interpreted as having been formed by the accentuated growth and accumulation of crinoids. The bioherms are considered to have been organic reefs because they formed wave-resistant organic structures which resulted in elevated prominences in a shallow sea. E. N. T.

1049. Marine Triassic stratigraphy in Eastern Great Basin. D. L. Clark. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2192–222.—This study was limited to the marine Triassic rocks in W. Utah, W. of the Wasatch Mountains, and to the Triassic rocks in NE. Nevada, E. of 116° W. Longitude. The purpose was a stratigraphic analysis of the marine Triassic sediments in the E. Great Basin. All known Triassic was studied, and localities of undescribed sections were obtained from geologists in the area. Sections were measured with a 100-ft steel tape and Brunton compass. Samples obtained were treated in the lab with 1 : 7 glacial acetic acid. Microfossils from the rocks were studied in an attempt to establish correlation between sections, and with the Moenkopi and Thaynes formations of Utah. E. N. T.

1050. Mississippian Joana limestone of Cordilleran Miogeosyncline and use of Ca/Mg ratio in correlation. G. V. Chilingar and H. J. Bissell. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2257–74.—The Joana limestone (Mississippian) is a ridge-maker between 2 non-resistant shales and forms an easily mappable formation because of its habit of forming characteristic escarpments and cuestas. It is rather widely developed in E. Nevada and W. Utah. The distribution and lithologic attributes of this formation are presented in preliminary form.

The Ca/Mg ratio was successfully used for correlation purposes over short distances. An attempt was also made to correlate the Joana limestone with the Gardner formation of Central Utah on the basis of Ca/Mg ratio. As variations of this type occur at 2 levels in the Gardner formation, the Ca/Mg ratios appear to have only a limited value in correlation over long distances. E. N. T.

1051. Devonian stratigraphy of Sulphur Springs and Pinyon Ranges, Nevada. D. Carlisle *et al.* *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2175–91.—The Sulphur Springs and Pinyon Ranges in N. Central Nevada together form an almost continuous basin range 5–10 miles wide and 70 miles long, rising approx 3000 ft above the basins on either side.

This paper describes 4 widespread and distinctive lithologic sub-divisions of the Devonian strata. The 3 lower units are placed within the Nevada formation, and the uppermost unit is assigned to the Devil's Gate limestone. E. N. T.

1052. Franciscan group in Coast Ranges and its equivalents in Sacramento Valley, California. W. P. Irwin. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2284–97.—The Franciscan group is an assemblage of detrital and chemical sedimentary and volcanic rocks that crops out discontinuously in a structurally complex, NW. trending belt along the Coast Ranges of California. On the E., along the W. side of the Sacramento Valley, a thick section of detrital sedimentary rocks has been subdivided into the Knoxville, Paskenta, and Horsetown formations of Late Jurassic and Early Cretaceous age, and several units of early Late Cretaceous age. The Sacramento Valley section represents deposition during most of the time from Late Jurassic to early Late Cretaceous.

The Franciscan group is widely held to be restricted to Late Jurassic age, the Knoxville formation to be an upper shaly phase of the Franciscan group, and the 2 to be overlain unconformably by detrital strata of Cretaceous age. Sparse palæontologic evidence indicates this view to be incorrect. Rather, the Franciscan group seems mainly to have been deposited contemporaneously with the Knoxville, Paskenta, Horsetown, and lower Upper Cretaceous strata, as fossils ranging from Late Jurassic to early Late Cretaceous in age have been found in the Franciscan group. The Franciscan group and strata of the Sacramento Valley section therefore may represent 2 facies of the same stratigraphic section. E. N. T.

1053. Palæontology and stratigraphy of some marine Pleistocene deposits in Northwest Los Angeles basin, California. P. U. Rodda. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2475–92.—Recent excavations made in the Cheviot Hills, Los Angeles County, California, have exposed fossiliferous marine Pleistocene strata. 2 new formations occur in this area. The Lower Pleistocene Anchor silt consists of 60 ft of soft buff silts, and is unconformably overlain by the Upper Pleistocene Medill sand, consisting of 60 ft of greyish, loosely consolidated sand and gravel. E. N. T.

1054. Micropalæontological working methods in the United States of America. Report on a study trip to California. (In German.) H. Hiltermann. *Erdöl u. Kohle*, 1956, **9**, 750–3.—A critical study of palæontological work in U.S. universities and lab compares German methods. The U.S. work is strongly supported by the public and petroleum industries. Extensive work on ecology of recent foraminifera is undertaken by the U.S. petroleum industry. In the U.S.A.

hard rocks are boiled with NaOH before lixiviation, in Germany with H_2O_2 and Na_2SO_4. In Washington transfer of opaque $CaCO_3$ to translucent CaF_2 is performed to render morphological details, *e.g.* pore canals, readily visible. They are recognizable almost as clearly as in recent and *tert* examples. The method is used also for foraminifera, bryozoa, molluscs, and brachiopods. From the shell substance of fossils, *e.g.* of selected foraminifera, the ratio of the 2 oxygen isotopes ^{18}O and ^{16}O is determined by the mass spectroscope. This gives conclusions on the temp at the time of formation of the shell lime. A plate with legend illustrates the microfossils applicable for study, chiefly from the nannoplankton. R. T.

1055. Trinidad looks offshore. Anon. *Petrol. Engr*, 1957, **29** (7), B109–10.—The inland fields of Trinidad are old and declining in production, so that offshore exploration has been stimulated. An offshore drilling rig is in operation, and oil has been struck in coastal concessions by deviating wells sunk in the beaches. E. A. G. H.

1056. Distribution of recent foraminifera off west coast of Central America. O. L. Bandy and R. E. Arnal. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2037–53.—A survey was made of the foraminiferal distribution in the sediments off the W. coast of Central America, between depths of 6 and 6270 ft. 36 samples were examined from areas off Acapulco, off the Gulf of Fonseca, and from the Gulf of Panama. A few of the samples represent intervening areas. The composite frequency distribution of foraminifera is plotted against changes in depth, temp, and salinity.

As a result of this investigation a number of faunal zones have been recognized. With them are the following associated offshore trends: (1) increase in number of species away from shore; (2) increase in foraminiferal number out to the upper bathyal zone and a decrease beyond; (3) greatest abundance of plankton in the outer shelf zone; (4) and abundant radiolaria and diatoms below depths of 4000 ft. E. N. T.

1057. Modern evaporite deposition in Peru. R. C. Morris and P. A. Dickey. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2467–74.—The Bocana de Virrila is located on the coast of NW. Peru in the Sechura Desert. It is a relict river channel which forms an estuary with an open connexion to the Pacific Ocean. The topographic features of this ancient river bottom and the excessive aridity of the region have combined to form an interesting example of the deposition of evaporites in an arid climate. It is the purpose of this report to describe where and how these processes are taking place and to confirm some of the hypotheses postulated by other workers concerning the deposition of salts in a restricted estuary where evaporation exceeds precipitation plus run-off. E. N. T.

1058. Persian Gulf test spudded. Anon. *Oil Gas J.*, 14.10.57, **55** (41), 121.—A well is being drilled from a barge on the Manifa structure, 9 miles off the Saudi Arabian coast in the Persian Gulf. It is *ca* 20 miles from the S. end of the offshore Safaniya field. C. A. F.

1059. Oil prospecting in the Niger delta. R. Bell. *Petroleum, Lond.*, 1957, **20** (8), 299–300.—Helicopters have proved very valuable for prospecting in swamp and jungle where progress may only be made slowly by water. E. A. G. H.

1060. The oil geology of the Australasian regions. J. C. M. Taylor. *Petroleum, Lond.*, 1957, **20** (9), 327–30.—The Australasian regions produce at *ca* $\frac{1}{16}$ of the present Middle East rate, and almost all production occurs in Sumatra, Java, Borneo, and Dutch New Guinea. The proved reserves of these islands are *ca* 3000 million U.S. brl. Although Australia possesses a large amount of sedimentary rocks, oil has not been found in large quantities because of unfavourable conditions. However, exploration continues. E. A. G. H.

1061. Oil prospects of the Magura plateau together with lower units in the zone south of Gorlice. P. Karnkowski. *Nafta (Krakow)*, 1957, **13**, 177–80.—The region is well-known for its oil-bearing strata, which were brought into production between 1854 and 1951. Systematic work on a small scale has been going on in the region since 1947, directed towards a better understanding of its geology. By means of a map and a section the pre-eminent feature of complicated folding is well illustrated, whilst the article serves as a description of the features of that area. A similarity between Magura and Moinesti region in Rumania suggests itself strongly. M. S.

1062. Problems of exploratory surveys and drilling for oil and gas in Poland. J. J. Zielinski and Z. Olewicz. *Nafta (Krakow)*, 1957, **13**, 237–40.—3 features must be present to make it worthwhile for the prospector to search for oil. They are the discovery of a sedimentary basin, impermeable dome structure, and discovery or appearance of bitumens or gaseous hydrocarbons in the area. Such discovery and foreknowledge must be followed by careful mapping, geophysical, and interpretational work, followed by exploratory drilling. In Poland such work is in various stages of completion in different areas. Central Carpathian depression, which has so far yielded 8 million tons of crude, still has potential oil resources, and drilling to depth of 2 km is required. Similar work is required in other Carpathian areas which have been extensively reconnoitred over the last 100 years. The Carpathian Foothills are the source of several seepages and gas wells. Less familiar is the Central and N. Polish basin, and on the whole a great deal of preliminary work is still to be done before drilling. This area, much larger than the others, should require 391,000 m drilling; Carpathians, 182,000 m; and Foothills, 167,000 m. The total cost of this will reach 1,800,000,000 Zl or the price of 1,800,000,000 kg of crude—the yearly import figure. M. S.

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

1063. Gravity anomaly simulator. J. A. F. Gerrard *et al. Rev. sci. Instrum.*, 1957, **28**, 438–42.—An instrument that will simulate the anomalous gravity effects of a subsurface body having a density differing from that of its surroundings is described. The device makes use of the similarity between the gravity equation and Lambert's cosine law, and enables the geophysicist to synthesize the anomaly-producing body in a much shorter time than that required for conventional computation methods. The applications described in detail include gravity anomaly profiles over a vertical and a 45° inclined dyke, over salt domes, and the resolution of 2 subsurface bodies. The various errors are discussed, and it is concluded that the accuracy is generally within $\pm 5\%$ of the max anomaly. H. C. E.

1064. Vanadium, nickel, and porphyrins in thermal geochemistry of petroleum. G. W. Hodgson and B. L. Baker. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2413–26.—Vanadium and nickel have been recognized as constituents of crude oil for a number of years, although it has not been clearly understood how these metals enter the oils. The available data about the occurrence of vanadium and nickel in different crudes appears to be badly scattered, due undoubtedly to non-uniform selection in sampling.

The object of the research described in this paper was to examine one of the various agents that might be operative in the maturing of crude oils, and it was first directed to an examination of the effects of heat upon the presence of metals

in a crude oil. It was found that present-day reservoir temp are too low to permit a significant thermal contribution to the changes which appear to have occurred in crude oils. The relatively constant proportion existing between porphyrin content and metal content in a widely varying series of Canadian oils confirms the conclusion that thermal action cannot be of great importance in these processes. E. N. T.

DRILLING

1065. Principles and prospects of drilling with counterflushing. (In German.) B. Petuch. *Erdöl u. Kohle*, 1956, **9**, 762–4.—Since world war II deep drilling methods have received great attention for economic and tech reasons. The modified counterflush process with mud circulation, air, petroleum, or waste gases, as circulating medium, is superior to other processes in many cases. Gases give good results in areas short of water, or in heavy formations. The counterflush process with gas circulation has proved successful, especially in creviced, spongy, or hard rock. Greater drilling progress, surfacing of unexpectedly large and easily identified rock samples, and prolonging the bit life are impressive. Suction on the bottom of the hole—by complete removal of the chips—prevents formation of a filter cake or paste. The time required to raise chips from a 1000-m deep borehole is 7–10 minutes compared with 2 hr for conventional methods. R. T.

1066. Sinking rate of drilling fines and their influence on circulating sample investigations. (In German.) G. Schmitz. *Erdöl u. Kohle*, 1956, **9**, 757–62.—Errors in assigning drilling fines samples to their original formations arise from inaccurate determination of the true upward velocity of the chips in the mud stream. Admixture with intervals drilled shortly before occurs. The impurities are caused by the variable sinking rates of particles of equal size in the circulation stream. Investigations were carried out during drilling to different depths. The actual upward velocities of the particles and of the drilling mud were measured. The sinking rates of the particles agreed with val from lab experiments and earlier measurements in test wells. Experimental and mathematical val of sinking rate for turbulent sinking, and experimental val for laminar sinking could be related to drilling mud properties in curves, which are applicable for a time lag determination of rock samples. The type of sample contamination from intervals drilled previously could be shown, and it is possible to define approx the contamination degree by means of the sinking-rate diagram. R. T.

1067. Save up to 25 per cent on 7500-ft well. J. M. Camp, J. E. Ortloff, and R. H. Blood. *Oil Gas J.*, 7.10.57, **55** (40), 141.—Field tests of drilling a 7500-ft well with casing and retractable rock bits have shown savings of up to 25% compared with conventional drilling costs. Wells were drilled in Oklahoma, near Seminole, and 7-inch o.d. streamlined casing was used for the drill string. 3- and 4-cone retractable bits were used; these pass in collapsed position through the casing and are then expanded to cut a 9¾-inch hole which allows the casing to pass. The bits are carried on a sand line. Details of the technique are given with diagrams of the equipment. Results show that the 3-cone bit was more successful than the 4-cone type, and its performance compares very favourably with conventional tricones. C. A. F.

1068. Rotary or percussion (churn) drilling in the Carpathians. J. Wojcik. *Nafta (Krakow)*, 1957, **13**, 240–8.—In Poland percussion drilling is mostly confined to the Carpathians, and even there to shallow drilling (less than 1000 m). The method, however, far from being obsolete, is used in the U.S.A. to the extent of over 15%. 3 recent Polish jobs are described where comparison has been made and it has been found that the older method has its merits, but generally speaking the method is slower and more expensive. Since all percussion equipment is available in Poland and rotary has to be imported, the financial advantages are sufficient to retain it in the field of work for which it is well adapted and where the crews are more familiar with it. Drilling down to 1500 m can be easily done this way. In the discussion the opinion was expressed that what percussion drilling is still done should be concentrated in the Carpathians. The chairman of the conference, Chief of Petroleum Department of the Ministry for Mining and Power, summed up by stating that he agreed that exploratory work could be done better by using the percussion method. M. S.

1069. Blowout control begins before they occur. H. N. Mead. *Petrol. Engr*, 1957, **29** (10), B31–8.—When pulling tools from a drilled hole, blowouts may occur due to a reduction in pressure in the mud at the bottom of the string, depending on the surface pull. Other causes are a bubble of fluid lighter than the mud in the hole, and a " pressure inversion " effect. Useful safety precautions are given. E. A. G. H.

1070. Effect of drilling and completion methods on producing well performance. G. M. Stearns. *Petrol. Engr*, 1957, **29** (9), B35–8.—The effect of such features of the completion process as type of drilling fluid, length of exposure of drilling fluid to producing section, perforating methods, well clean-up methods, cementing methods, and sand control on future well performance is described. Any detrimental effects of these features may be remedied by fracturing, acidizing, or surfactant treatment. E. A. G. H.

1071. Formation fractures in one controlled plane. J. E. Kastrop. *Petrol. Engr*, 1957, **29** (9), B21–5.—A jet perforator has been designed to create stress patterns in formation rock by 3 almost parallel co-planar perforations in opposite sides of the casing, so that the control of the direction of a single fracture may be permitted. Advantages of fracture control which vary according to reservoir location and hole depth are given. E. A. G. H.

1072. New concepts spark drilling developments. J. A. LeVelle. *Petrol. Engr*, 1957, **29** (8), B39–40.—Recent developments in drilling techniques and equipment are reviewed. E. A. G. H.

1073. Drilling costs in California. R. C. Sharp and J. J. LaBouff. *Petrol. Engr*, 1957, **29** (7), B78–102.—Drilling costs in California are reviewed from contracting and operating viewpoints. The increase in operating costs has been offset by an increase in penetration rate, resulting in lower footage rates. E. A. G. H.

1074. New percussion drill shows great promise. Anon. *Petrol. Engr*, 1957, **29** (7), B32–4.—A new-type percussion drilling tool has been designed to increase penetration rates through hard rock with less hole deviation and longer bit life than obtained with conventional drilling, thus reducing drilling costs. E. A. G. H.

1075. Dry-hole money—the fair contribution. J. H. Folks. *Petrol. Engr*, 1957, **29** (7), B21–4.—Methods for determining the fair proportion of the cost of a dry hole to be borne by each interested party are presented. E. A. G. H.

1076. Central mud plant at Lacq. Y. Berger. *Bull. Ass. franç. Tech. Petrole*, Nov. 1957, 479–92.—At Lacq mud consumption per well is 500–1000 m^3, and 10 wells/year are visualized. Because of a pressure of 680 kg/cm^2 at 4000 m, heavy mud is needed also for workover operations. A central mud plant was put in operation in July 1957. This comprised silos for materials used in large amounts, stacking places for

bags of other materials, mixing and transfer plant, and storage tanks for the prepared mud, as well as tank wagons for its transport. These various features are described, together with the mixing operations, which enable 2 men to mix 20 m^3 of mud of density 1·8 in 2 hr. Compressed air is used for some transfer operations. Reference is made to means of dealing with settling in storage. Transport of mud is by tanks holding 10 m^3, and these can be filled or emptied at the rate of 1 m^3/minute. G. D. H.

1077. Completions with oil-base mud by S.C.P. A. Granier and E. Diemer. *Bull. Ass. franç. Tech. Pétrole*, Nov. 1957, 465–78.—Oil-base muds, as well as water-base muds, have been used for completing wells at Bled Eddoum and Khatara, some 20 km SW. of Petitjean. The Domerian and Lower Lias producing horizons consist of arkosic sandstones, breccias, and, at times, limestones, separated by marls, limestones, or dolomites. They are 1200–1450 m deep, have a minimum thickness of 100 m, and an average porosity of 20%. Until Sept. 1954, for wells in both these fields, a red mud was generally used, starch or C.M.C. being added to keep the filtrate at 5–7 cc in 30 min at Bled-Eddoum and 4–5 cc at Bled-Khatara. 5½-inch casing was cemented and shot with 12 shaped charges/m. Oil-base mud was first used on K.H. 16, and then it was used in subsequent wells, the techniques being to cement 7-inch casing at the top of the producing formation, and to drill the latter with oil-base mud, after which slotted 4½-inch liners were set. KEN oil or KEN FLO was mixed with gas oil and suitably loaded. This gave 1·7 cc of oil filtrate at 250° F with 100 p.s.i. differential. The mud was not affected by contaminants such as cement, salt, and anhydrite, and would tolerate up to 15% of water (dense muds would tolerate less water than light muds).

Comparison of wells completed with water-base and oil-base muds showed the latter to have the higher productivity indexes, even after allowing for perforations or liners. At Bled-Khatara the following relationship was found for water-base muds, $Q = 2{\cdot}413\ (1{\cdot}105)\ f/T$, where Q is output in m^3/day/m, f is API filtrate, and T is duration in days for completion.

The oil-base mud cost *ca* 39,000 fr/m^3, and starch mud *ca* 8000 fr/m^3. In 5 wells the former cost 7800 fr/m. Taking precautions, a cost under 5000 fr/m was obtained, which approaches 3000 fr/m for water-base muds. G. D. H.

1078. Mud pumps. J. O. Scott. *Oil Gas J.*, 14.10.57, **55** (41), 123.—Practical data on the installation, operation, and maintenance of mud pumps are presented with many diagrams and photographs showing equipment and operating conditions. C. A. F.

1079. Spacial geometry of drilling bit components. S. Karlic and B. Wielgosz. *Nafta (Krakow)*, 1957, **13**, 180–6.—In designing drilling bits large dia show several advantages. The article describes with great accuracy principles of design, best angles for the teeth depending on the kind of rock to be traversed, and under the sub-titles, such as " cylindrical bits," " conical bits," " straight and slanting teeth," covers all the details of bit design. M. S.

1080. Drilling machinery and equipment at the 26th International Fair at Poznan. R. Wolkowicz. *Nafta (Krakow)*, 1957, **13**, 254–8.—The main exhibitors were Austria, U.S.S.R., Rumania, and Federal (West) Germany. The reviewer lists exhibits which attracted his attention, mostly drilling rigs for percussion and rotary operations, as well as ancillary equipment. Special praise is given to W. German exhibitors Saltzgitter and Mercedes-Benz. Belgian, French, British, and Italian exhibits are also mentioned. M. S.

1081. Prospects for application of small diameter turbo-drills for small holes. R. Piatkiewicz. *Nafta (Krakow)*, 1957, **13**, 260–1.—The need is for mud pumps delivering fluid at 120–150 atm and suitable piping and bits, which are difficult to construct. One such was made and tried out in the U.S.S.R. in 1953–54. It was 4 inches dia. It has been shown that there is a great discrepancy between theoretically anticipated and practical results, due to the fact that certain parameters of radial velocity were substantially different in large and small dia equipment. Once this was adjusted, turbo-drills of dia 100 mm and less of predictable performance were constructed and are being used. M. S.

1082. Exploratory drilling in 1956 in the U.S.A. G. B. Moody *et al. Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 989–1289.—This is the 12th report based on the data gathered by the U.S. Committee on Statistics of Exploratory Drilling. The individual producing areas of the U.S.A. are dealt with by separate authors who describe the most important factors in their petroleum production history in 1956, while G. B. Moody, the Chairman of the Committee, presents a summary of the overall U.S. picture in a preliminary paper.

During 1956, 16,173 exploratory holes were drilled in the U.S.A. Of these 8709 were new-field wildcats, 3841 were new-pool tests (including new-pool wildcats, deeper-pool tests, and shallower-pool tests), and 3623 were outposts. Among the new-field wildcats, 868 were successful; among the new-pool tests 1021 were successful; and among the outposts 1207 were successful.

The total exploratory footage drilled in the U.S.A in 1956 was 73,981,176 ft in the 16,173 holes, or 4574 ft/hole. These figures compare with 69,173,209 ft drilled in 14,937 exploratory holes, with an average depth of 4631 ft, in 1955.

Exhaustive statistics are presented, and from these a number of significant conclusions are drawn and many comparisons are made. Perhaps most important are the facts pertaining to rank wildcats, which, when they are successful, discover entirely new fields.

In the last 13 years in the U.S.A. these have comprised approx 55% of the total number of exploratory holes. Of these new-field wildcats, the percentage located on technical advice has risen from 77 to 84%. In this same period nearly 3 times as many new-field wildcats have been successful when located on technical advice as those not so located. Taking all new-field wildcats into consideration, there has been an almost constant success-to-failure ratio. The average for the 13 years has been 11·70%, with a range from a low of 10·65% to a high of 12·22%. That is, one hole in every 9 has found some oil or gas.

Even more significant than these figures has been the study of the total ultimate reserves of oil discovered by these new-field wildcats. Briefly, this study, which is based on fields having a minimum of 6 years of development history, shows that only one new-field wildcat out of every 44 drilled discovers a field with as much as one million barrels of estimated total ultimate reserves. Nearly 98% of all new-field wildcats drilled are failures in that they are abandoned as dry or they discover reserves too small, on the average, to be profitable. E. N. T.

1083. Deep drilling through Cumberland overthrust block in Southwestern Virginia. D. M. Young. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 2567–73.—Since 1948, when gas was discovered in commercial quantity in Buchanan County, 180 wells have been completed in SW. Virginia. Much of the area under development lies within the boundaries of the Cumberland overthrust block, and 38 of the deeper wells have penetrated a zone of shearing near the base of the Devonian shale. This zone, which is very definitely indicated by strong gas blow-outs when drilled, is regarded as the sole of the Cumberland overthrust block. E. N. T.

1084. This mobile platform will tackle 600-ft water. R. L. Le Tourneau. *Oil Gas J.*, 7.10.57, **55** (40), 162.—A new

mobile drilling platform has been designed which makes it possible to drill in depths of water up to 600 ft. It is supported on 3 legs, which are self-elevating, and diagrams show the method of operation; the platform is floated to position, the 3 legs are lowered until just off bottom, and they are then set at a predetermined angle and set to bottom. Bottom resistance is obtained by the design of the leg feet, which can penetrate bottom sediments. The platform is finally raised to the required position above wave level.

The platform could be mass-produced; a unit capable of drilling 10,000 ft in depths of 150–300 ft would probably cost $11,000/ft of water depth. C. A. F.

PRODUCTION

1085. The use of a non-ionic detergent and citric acid for improving cleanout procedures of water-input wells in secondary oil-recovery projects. R. T. Johansen, J. P. Powell, and H. N. Dunning. *U.S. Bur. Min., Inf. Circ.* 7797, Aug. 1957, 1–18.—Tests with the ultimate object of increasing the eff of cleanout procedures—on wells selected because of known histories—are reported. The test site was Bonaventure Oil Corpn Wayside Flood No. 1, in Washington County, Oklahoma. The tested wells were completed in the Wayside sand at depths from 540 to 550 ft. Use of a non-ionic detergent in cleaning-out procedures, involving bailing, swabbing, and backflowing, effected moderate increases in injection rates for 2 input wells tested, W29 and W69, *ca* 20% and 40% respectively. Wellhead tests before and after detergent cleanout corroborated the results. Wellhead tests for W55 indicated improvement in injectivity index and skin effect. Well W42, used as a ref well, exhibited almost const wellhead behaviour throughout the test period. One benefit to all the wells treated with detergent was derived from flotation and removal of drilling clay, rock chips, and much iron oxide. A mixture of citric acid and non-ionic detergent was rather effective for increasing injection rates when proportioned into the wells under pressure. Effects of using citric acid and detergent in common solution are inseparable; when used singly, the effects are about equal in magnitude and duration. R. T.

1086. Verification of effectiveness of hydraulic fracturing. B. Fleszar. *Nafta (Krakow)*, 1957, **13**, 250–2.—Hydraulic fracturing is a simple and effective process, and the 25% of cases when it fails can be due to various causes. After the operation has been completed, a check should be done to locate the fracture. Thermometric, radioactive, and magnetic methods exist. In the former the location of the gap is found by pumping into the hole hot water and subsequently carrying out a logging operation with an accurate thermometer. Where the hole is, the bulk of the hot water will have been absorbed and a rapid temp rise will be observed. The drawback of the method is the damage to the reservoir that may be caused by hot water. Similar in principle is the radioactivity method. Here Fe^{59} soln has been proved to be most useful, as the isotope is easily deposited on sands and comparatively little water is required. Using the magnetic method involves a magnetic powder, such as powdered magnetite, which is added to a small quantity of liq. Whilst the method is simpler and safer than the former, its disadvantage lies in the fact that some of the rocks may become magnetized without actually picking up the powder and thus give a high reading like the fissure which has just been made. M. S.

1087. Hydraulic fracturing. R. Sorel. *Bull. Ass. franç. Tech. Pétrole*, Nov. 1957, 463–4.—At Bled Eddoum, fracturing raised the potential of DM.20 from 1·5 to nearly 150 m³/day. A graph showing the well's behaviour reveals that after 17 months the producing rate is, in spite of decline, still above the max attained before fracturing. The well has already given 8950 m³ more than was expected without fracturing, and may eventually give 12,500 m³. The treatment cost was Fr. 770,000, but the eventual gain is expected to be Fr. 100,000,000. G. D. H.

1088. Hallsville gas handling system. C. K. Gravis and R. E. Fields. *Petrol. Engr*, 1957, **29** (10), B109–23.—A low temp separation and stabilization system is described which handles the production of gas-condensate wells. Problems of subhydrate flowing temp, high liq vol, swamp conditions, and testing requirements were solved. E. A. G. H.

1089. Factors determining the effect of sand penetration into a fissure by hydraulic fracturing. B. G. Loguinov *et al.* *Nafta (Krakow)*, 1957, **13**, 213–14.—After briefly discussing the principles of hydraulic fracturing, the author discusses work done in Bashkiria and Tartary. There the sand would not adequately lodge in the fractured formation. The reasons for this are discussed, and the lesson of this incorrect procedure is set forth. The paper first appeared in *Nyeft. Khoz.*, **8**, 1956. M. S.

1090. Removing water to increase gas well productivity. N. F. Brown. *Petrol. Engr*, 1957, **29** (10), B90–107.—A free piston gas lift device has enabled the removal of water from the tubing in gas wells. Gas production has increased due to the throttling effect of the water being eradicated. E. A. G. H.

1091. Pressure drop across perforations can be computed. R. W. Brown and B. Gilbert. *Petrol. Engr*, 1957, **29** (10), B82–8.—A mathematical method for estimating the pressure drop across an oil well casing perforation is presented. Allowing also for friction losses in pipe, a more accurate estimate of well treatments is obtained. E. A. G. H.

1092. Water floods benefit by radioactive tracer techniques. J. W. Watkins *et al.* *Petrol. Engr*, 1957, **29** (10), B53–63.—Radioactive isotopes provide a knowledge of subsurface fluid flow in oil reservoirs, and any irregular flow conditions in and between wells are detected. The efficiency of water flooding and production may then be increased. E. A. G. H.

1093. How to evaluate gas well damage by pressure build-up tests. R. S. Wansbrough. *Petrol. Engr*, 1957, **29** (10), B47–52.—The results of pressure build-up tests may now be used to analyse and solve routine well problems, using recent studies of the unsteady flow of compressible fluids in porous media. E. A. G. H.

1094. Unusual Magnolia field water flood plan. S. W. Kingsbury. *Petrol. Engr*, 1957, **29** (10), B40–6.—In a lime dome oil reservoir, uneven movement of injection water was occurring, due to impermeable lime barriers. A utilization programme of controlled water injection in various zones is levelling oil–water contacts. Oil is now being produced at a greater rate more efficiently, and less injection water is required to maintain reservoir pressure. E. A. G. H.

1095. Oil recovery by miscible displacement after water flooding. A. W. Talash and P. B. Crawford. *Petrol. Engr*, 1957, **29** (10), B27–30.—Lab studies to determine the quantity of oil that may be recovered by the application of a miscible flood, using a liq petroleum solvent, after water flooding, showed that recovery was almost complete. E. A. G. H.

1096. Latest oil recovery idea. N. J. Clark, G. M. Andreen, and A. J. Wessely. *Petrol. Engr*, 1957, **29** (10), B21–6.—A combination of known methods of increasing oil recovery, which uses a primary injection of water followed by LPG and then gas, is suggested. The gas drives both liq and

recovered oil through the reservoir pores to achieve a high ultimate oil recovery. E. A. G. H.

1097. Graphic method used in predicting gas-condensate well productivity. R. C. Prian and O. R. Gomez. *Petrol. Engr*, 1957, **29** (9), B53–76.—Gas flow rates from newly drilled gas condensate wells may be estimated, within 10% error, using a graphical method and standard well data. E. A. G. H.

1098. Combat water-coning by injecting reverse-wetting additives. A. S. Michaels, R. I. Bergman, and D. L. Brown. *Petrol. Engr*, 1957, **29** (9), B45–52.—Encroachment of water into the oil-bearing stratum immediately below a well, or water-coning, is one cause of decreased oil production. Lab studies on a model of a water-drive reservoir subject to water-coning indicate that, in highly permeable formations, treatment by aq soln of reverse-wetting additives prevents or minimizes water intrusion and substantially increases oil production. E. A. G. H.

1099. Short-cut valuation of producing properties. C. A. Awalt. *Petrol. Engr*, 1957, **29** (9), B39–42.—To value a producing oil or gas lease, a rapid method is developed which provides a fairly accurate estimate. E. A. G. H.

1100. Latest production methods open up new horizons. J. E. Kastrop. *Petrol. Engr*, 1957, **29** (8), B61–2.—Current progress in methods for increasing oil well production is described. E. A. G. H.

1101. Fundamental design of gas lift systems. C. V. Kirkpatrick. *Petrol. Engr*, 1957, **29** (7), B41–9.—Factors governing the selection of a method of gas lift for wells are discussed, and the design of continuous and intermittent gas lift systems is presented. E. A. G. H.

1102. Choice of a water supply for water flooding. D. E. Menzie. *Petrol. Engr*, 1957, **29** (7), B25–9.—A literature survey indicates that water requirements in oil production will double in the next decade. Suggested water injection rates for sands are 0·3–1·5 brl/acre-ft/day. Both fresh water and brines have been used increasingly for water flooding. The quality of the water supply determines the amount of conditioning required to remove corrosive constituents and suspended matter, which may cause plugging. Subsurface water is the largest of the numerous sources of water for water flooding. 26 refs. E. A. G. H.

1103. Electrical resistivities of oilfield brines in North-east Texas. M. E. Hawkins. *Petrol. Engr*, 1957, **29** (7), B52–68. —Water resistivity data of formations in NE. Texas are presented. The data are essential in interpreting electric logs of wells to obtain formation porosity and interstitial water saturation. E. A. G. H.

1104. How fractured limestone responds to gas injection. Pt 1. W. E. Nolan and G. R. Locker. *Oil Gas J.*, 7.10.57, **55** (40), 156.—Gas injection operations in the Fullerton field of NW. Andrews County, Texas, are described. The reservoir is the Permian Lower Clearfork dolomite at *ca* 6700 ft in an anticlinal structure which has closure on 2 domes, but the productive area is limited by porosity pinchouts which are not parallel to the stratum contours. Thickness of the producing zone ranges from 500 ft gross at the crest to 250 ft gross on the flanks.

Natural drive is solution gas with no detectable bottom water movement. Original b.h.p. was 2980 p.s.i. static, and because of the inefficiency of the primary mechanism some 24,000 acres of the field were unitized for secondary recovery in 1954. By Sept. 1956 the vol of injected gas had reached 25 M.M.c.f.d. Cumulative vol injected into 20 wells was 17·8 billion cu. ft. by Jan. 1957.

Details of production performance are given. It has been calc that the injection programme will recover 4% more oil than would be expected by primary recovery, assuming that 80% of the gas is returned to the reservoir. This increase represents *ca* 1000 brl/acre in the injection area.

Diagrams and maps show production performance and bottom hole pressure and gas–oil ratio changes. C. A. F.

OILFIELD DEVELOPMENT

1105. Green River push is on. J. C. McCaslin. *Oil Gas J.*, 14.10.57, **55** (41), 299.—The Green River basin is the least tested basin of the Rocky Mountain area of the U.S.A., although oil seeps have been known for a long time, but recent developments have accelerated activity in the area. The Pacific NW. pipeline, which passes through the basin, has emphasized the importance of gas development in the region, and there has been new drilling in old areas as well as wildcatting. It is the most promising basin for large gas reserves in Wyoming. A few recent discoveries are noted; at Dry Piney, for example, in the W. part of the basin, a well has reported 10,000 M.c.f/day from the first Frontier sand. C. A. F.

1106. Great Lakes leases offer new drilling area. B. C. Donnan. *Oil Gas J.*, 14.10.57, **55** (41), 301.—It is expected that in the near future all the states bordering Lake Erie will have authorized the sale of offshore leases. Already development is taking place offshore from Ontario in Lake St Clair in the W. part of the lake, where gas wells have been completed. The general geology, drilling methods, and legislation affecting development in Lake Erie are discussed, and diagrams show the offshore acreage and present fields in the area. Potential pays occur within the Cambrian, Ordovician, Silurian, and Devonian, and the oil possibilities of these are evaluated, there being 7 plays extending offshore.

Cable tool drilling has proved the best method for S. Ontario, rotary rigs sometimes being used for high-pressure completions, and wells are drilled from steel towers supported by piles driven into the lake bottom; locations are made by triangulation.

Legislation for work offshore from Ohio and Pennsylvania has recently been passed. C. A. F.

1107. Developments in Eastern Canada in 1956. W. D. Brittain and J. D. McAlary. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1303–10.—In 1956 oil production in E. Canada amounted to 593,400 brl, an increase of 13% over 1955. Total gas production increased by 21% over the previous year, and a significant discovery of natural gas was made in SW. Ontario in a reef in Huron County.

The bulk of the exploratory work in E. Canada was carried on in the proved oil and gas areas of SW. Ontario, but in addition there was considerable activity in other parts of the E. provinces. E. N. T.

1108. Developments in Western Canada in 1956. J. A. Downing and S. F. Tuddenham. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1290–302.—The bulk of the exploratory effort during 1956 in W. Canada was again in the provinces of Alberta and Saskatchewan. The total number of wells drilled during the year was 3283, with a total drilled footage of over 15,400,000 ft, representing an average of 4709 ft per well.

Production of oil and natural gas increased by 32% over the previous year with a total oil production of 171 million brl.

The most important discovery of the year was made in rocks of pre-middle Devonian age, the "granite wash." E. N. T.

1109. Petroleum developments in South America and Caribbean area in 1956. E. W. Clark. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1454–501.—Oil production increased in 1956 in practically all the producing S. American countries. Trinidad also showed a marked increase in production. The total production during the year was approx 1,036,588,000 brl (2,832,000 b.d.), which is 13% above the 911,229,000 brl (2,497,000 b.d.) produced in 1955. The most substantial increase was in Venezuela, where 1956 production was nearly 112,000,000 brl (307,000 b.d.) more than in 1955. Following closure of the Suez Canal, Venezuelan production increased rapidly, and at the end of the year had reached more than 2,700,000 b.d. In Brazil, an active exploration and development programme continued. Trinidad production increased for the fourth consecutive year, and offshore drilling and production in the Gulf of Paria got under way.

Exploration drilling in S. America and the Caribbean area, as measured by the number of wells drilled, dropped off in 1956, when 306 wells were drilled as compared with 635 in 1955. However, the number of development wells completed increased 17% in 1956 to a total of 2300 wells. Wide foreign interest was evident in several Central American countries during the year, as new petroleum laws encouraging foreign investment came into effect in Guatemala, Panama, and Costa Rica. E. N. T.

1110. Petroleum developments in Mexico in 1956. E. J. Guzman and F. Mina U. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1441–53.—During 1956, the bulk of the exploratory effort in Mexico was concentrated in the already proved coastal plain provinces. There was an increase of over 21% in the number of wells drilled during the year compared with 1955, and 267 (66·4%) of these wells were successful.

Production of crude oil during 1956 rose by 2,726,230 brl to a total of rather more than 94 million brl during the year. E. N. T.

1111. Pemex hits deep pay. Anon. *Oil Gas J.*, 7.10.57, **55** (40), 122.—A new deep discovery is reported from the area of the San Andres field in the S. Golden Lane trend of Mexico. The well, 1 Gran Morelos, was completed at 10,518 ft in Upper Jurassic limestone and has a potential of over 5000 b.d. Several other wells in the area have recently been successful.

Old shallow production along the Golden Lane trend is declining rapidly, but the recent deep pays should offset this, and it is expected that Mexican production will increase to 300,000 b.d. or more by the end of 1958, largely due to further development of the San Andres field. This is a fairly new field, and there are now 27 producing wells. C. A. F.

1112. Developments in Alaska in 1956. R. L. Blocher. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1311–15.—Drilling activity in Alaska declined slightly during 1956, when 3 out of a total of 4 tests were deepened or commenced during the summer and suspended in the early autumn. 3 of these are Tertiary tests, and the fourth is a test of late Mesozoic sediments.

The total footage drilled in 1956 was 15,168 ft. E. N. T.

1113. Paria drilling set. Anon. *Oil Gas J.*, 14.10.57, **55** (41), 121.—A company has been formed to explore in a concession area some 152,000 acres offshore in the Gulf of Paria between Trinidad and Venezuela. The first test will be drilled 6 miles offshore in 90 ft of water from a drilling platform; it is *ca* 10 miles from offshore production in the Soldado field of Trinidad. Several other platforms have been sited. C. A. F.

1114. Petroleum developments in Middle East and adjacent countries in 1956. H. Hotchkiss. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1591–615.—Petroleum production in the Middle East countries in 1956 totalled 1,257,611,320 brl, an average of 3,455,350 b.d. This compares with a total production of 1,183,951,800 brl in 1955.

Production in India and Pakistan in 1956 was 4,990,070 brl, an average of 13,650 b.d. This compares with 4,594,000 brl in 1955.

The Garzan field in Turkey went on production in Oct. 1956.

An important discovery was made at Qum in Central Iran, when Alborz well No. 5 flowed wild at rates estimated between 80,000 and 100,000 b.d. Another important discovery was made in Saudi Arabia, when Aramco's Kharsaniya No. 1 found oil in commercial quantities. Exploratory work continued in Kuwait with results which appear to be very encouraging. A possible commercial discovery was made in Syria. E. N. T.

1115. Petroleum developments in Africa in 1956. H. D. Hedberg. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1540–90.—1956 was a momentous year in the history of petroleum exploration in Africa, since, in spite of a decline in production to under 13 million brl—the lowest point since 1947, important new discoveries were made in French Equatorial Africa, Angola, Nigeria, and in the Algerian Sahara.

A total of 1,499,566 ft of drilling was carried out (twice the amount of the preceding year) and 58 rigs were in operation at the end of the year. 93 exploration wells were completed, of which 28% were successful; 61 development wells were completed with a success of 79%. E. N. T.

1116. Petroleum developments in Far East in 1956. G. F. Kaufmann. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1616–32.—The increased demand for petroleum products from areas outside the Middle East, which resulted from the Suez crisis, had little effect on oil production from the Far Eastern fields because most of them were already being produced at the max safe rate. Production from the Far East in 1956 did show an 8% increase over 1955, from a daily average of 393,183 brl in 1955 to 424,208 brl in 1956. Most of this increase was from Central Sumatra fields. E. N. T.

1117. Petroleum developments in Europe in 1956. R. E. King. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1503–39.—Discussion of developments in the Soviet Union and associated countries has once more had to be omitted from this review. Production of oil in W. Europe rose by 10% to a total of 72,550,638 brl in 1956.

For the first time, production from Germany surpassed that of Austria, which showed a slight decline from the previous year. The first oil discovery was made in the Molasse basin of W. Austria. In Germany, the Elsfleth field NW. of Bremen was the first discovery in a newly-found Jurassic trough; as production in NW. Germany occurs chiefly in such Jurassic troughs, this new field may have considerable significance. In Sicily an important discovery of 7° API oil was made at Gela. 3 important and 6 minor gas discoveries were made in the Po valley. Development in the Adriatic coast Tertiary trough, which was encouraging in 1955, gave disappointing results in 1956. Production in the fields in the W. Netherlands increased, and 3 new oilfields were discovered. Early in 1956 petroleum licences were granted to 8 companies covering the Tertiary basin of Turkish Thrace, and active geological and geophysical exploration began. E. N. T.

1118. Technical progress in oil exploitation in U.S.S.R. F. Triebin and I. Zlotnikov. *Nafta (Krakow)*, 1957, **13**, 212–13.—Production of crude in U.S.S.R. in 1955 was 71 million tons. In 1950 it was *ca* 37 million tons, and in 1960 it will reach 135 million tons. This rapid increase is partly due to the fact that turbo-drilling is being applied in 85% of cases. 2- and 3-stage turbines are now being used with mud at up to 140 atm. A good deal of drilling is done using well-bottom electric motors for drilling. Within the current 5-year plan production

drilling is to increase by 85% and exploratory drilling by 95%. Treatment of reservoirs by various methods is of great importance. Among those is the " extra-contoural " flooding by pumping water into sandstone beyond the oil-bearing limits. New oil-bearing sands in Bashkiria, Tartary, and Kuybishev regions have been the object of treatment designed to give fast and full oil production. " Inter-contoural " and " central " flooding methods supplement the other method. To cope with these requirements, developments have been made in the construction of more powerful pumps of greater capacity. Repressurizing using gases has also been widely employed. Perforation, shooting, and formation fracturing are briefly mentioned, as well as the fact that many producing operations in the oilfields are completely automatic in some areas of the U.S.S.R. Isotopes are used for tracing the contour of the oil reservoir. M. S.

TRANSPORT AND STORAGE

1119. Compact concrete as material for oil and gasoline tank construction. F. Lecznar and S. Oskroba. *Nafta (Krakow)*, 1957, **13**, 197–204.—Although a little more expensive than steel, they are more permanent. Due to their porosity they would be unsuitable, but since cavities and capillarities in the concrete, provided they do not communicate with each other, do not cause losses, these concrete tanks are quite suitable, as long as there is more cement than sand and ballast. Water content and curing time are also important. According to the work done by the Department of Ferro-concrete Building at Krakow Polytechnic, such choice of conditions is possible to achieve success. Work was carried out with special reference to Polish cements, and results are tabulated. M. S.

1120. Esso Winchester. Anon. *Fluid Handl.*, 1958, 9–10.—Description is given of the recently launched 36,040-dwt tanker *Esso Winchester*, which has 33 tanks in 11 sections, one section being permanently for water ballast. Cargo can be discharged by 4 pumps in 9 hr at 4350 tons/hr. Tank cleaning, gauging, and fire-fighting arrangements are described. W. A. M.

1121. Pipes for pipelines. G. Marelle. *Rev. Inst. franç. Pétrole*, 1957, **12**, 1224–35.—API spec 5L and 5LX for seamless steel pipes for pipelines are detailed. Formulæ are given for calculating wall thicknesses for hydrocarbon pipelines conforming to A.S.A. B 31–1–1955. Manufacture, inspection, and testing of seamless steel pipes are described. W. A. M.

1122. Combating paraffinous sediments. S. Rachfal. *Nafta (Krakow)*, 1957, **13**, 186–91.—One of the pipelines which was blocked by paraffinous sediments was that from Osobnica to Jaslo. The resulting damage and work involved in clearing the line caused the regional production group " Karpaty " to consider the appropriate preventive measures. Crude from Osobnica is a typical high paraffin crude and solidifies immediately on leaving the well. Present heating arrangements cause uneven heating of the stored crude before pumping. During pumping to Jaslo it is supposed to cool from 50° to 35° C. Gas obtained on heating is stabilized and used as required. These recently introduced processes were suspected of being the cause of trouble. Tests carried out at the Polish IP, summarized in two tables, relate the visc and pour point to the treatment temp, and they show the variations in crude from the same source taken at different times. In all cases degassing has an adverse effect on the solubility of wax in crude. This is represented in 2 graphs: pour point *v.* degassing temp and visc *v.* temp before and after degassing at 50° C, which shows that visc of 27·5 cS was reached by the unstabilized crude at 21° C and after degassing at 5° C. This shows that by choice of a suitable working temp the pour point and visc can be depressed. Thus, if degassing is done at 25° C, pour point is raised, whilst by operating at 50° C it is lowered. There are indications that such changes are temporary, of about one week's duration. The aforesaid experiments explain the mode of crystallization of the crude in the pipeline *en masse*, but not the formation of sediments. These were found on inspection to be biggest in the initial section of the pipe, *i.e.* where the crude was warmest, but where the cooling was fastest. Doubling the rate of flow was an answer to this problem. Trouble occurred again when gas at low pressure was run through the oil line which has not been thoroughly emptied. The residues were subjected in that fashion to an evaporating process which caused precipitation of wax. The remedy here was the increase of gas pressure. Conclusions are summarized under 8 points. M. S.

1123. Pipelining LPG. F. B. Neptune. *Pipe Line Ind.*, 1957, **6** (5), 60–4.—Phillips Pipe Line Co. has been pipelining C_4H_{10} for over 25 years, and C_3H_8 for 10 years. Since 1947 *ca* 17 million brl of C_3H_8 have been shipped. Answers to some of the toughest problems faced since LPG operations began are discussed. Mechanical seals, deration of pumps, careful buffering, and leak repair practices are discussed. R. T.

1124. Unattended pipeline deliveries work. W. D. Lomax and H. W. Wilker. *Pipe Line Ind.*, 1957, **6** (5), 43–5.—Standard Oil Co. (Indiana) has equipped its Colon, Michigan, bulk plant with automatic facilities, permitting unattended pipeline stock delivery direct to plant tankage. Advantages and disadvantages of the successful project are discussed. R. T.

1125. Which are more economical—loops or boosters? N. B. Mavris. *Pipe Line Ind.*, 1957, **6** (5), 36–42.—Graphic comparisons are presented of the effects of automatic operation of a booster station with a manned operation or with the use of a loop line. A detailed summary of investment costs is given. R. T.

1126. Equation gives friction factor. B. Miller. *Chem. Engng*, 1957, **64** (12), 253–4.—The author uses new experimental data on the pressure drop through natural gas pipelines to show that the friction factor f can be related to the Reynolds No. Re by the empirical relation

$$1/(2f)^{\frac{1}{2}} = 2{\cdot}54 \log (Re) - 2{\cdot}17$$

for smooth pipe, from the beginning of turbulent flow up to Reynolds No. of 10 million. Extensions of the relation up to $Re = 50$ million have been used in design, but not yet verified experimentally. Actual pipes with couplings or welded joints have a pressure drop 5–10% higher. P. J. O.

1127. Flow formulas for natural gas. M. Brooke. *Chem. Engng*, 1957, **64** (12), 218.—Formulas for flow through pipelines at high and low pressure, through swaged nipples to atmosphere and through tapered lines are presented. P. J. O.

1128. Underground aluminium gas line. R. S. Dalrymple. *Corrosion*, 1956, **12** (12), 602–4t.—After being buried and in use for 5 years a protected and an unprotected aluminium gas line are compared. In this case it was found that protection was not needed, but in general it is thought necessary to coat aluminium gas lines and supply cathodic protection. F. M. G.

1129. Synchronous motors are paying off. F. P. Guertzen. *Oil Gas J.*, 6.1.58, **56** (1), 97.—Texas Eastern Transmission Corpn has 3 15,000-h.p. single-unit electric motor-driven compressor stations operating on a 30-inch natural gas transmission line from Mississippi to Pennsylvania. It is claimed that synchronous motors have unparalleled efficiency.
G. A. C.

1130. Preventive maintenance for magnetos. J. T. Carter, Jr. *Petrol. Engr*, 1957, **29** (10), D50–61.—A workable programme of maintenance for the magnetos of compressor engines in gas pipeline stations reduced costs and almost eliminated magneto failures during operation. E. A. G. H.

1131. New construction ideas promise 100-year life for offshore line. D. M. Taylor. *Petrol. Engr*, 1957, **29** (10), D24–8.—A coated pipeline with cathodic protection has been completed with a 100-year designed life. The line was dragged from the shore by a barge and sled, and television was used for underwater inspection during construction so that damage to the coating was minimized. E. A. G. H.

1132. Automation makes gas system designing easier. S. Ochi. *Petrol. Engr*, 1957, **29** (10), D20–3.—The application of electronic computers to the design of gas pipelines, producing accurate data rapidly, is illustrated by an example.
E. A. G. H.

1133. Pipelining congealed oil in Sumatra. J. M. Rupert and B. N. van Diemen de Jel. *Petrol. Engr*, 1957, **29** (9), D54–7.—Difficulties of constructing a pipeline through hilly jungle to transport a crude oil of a visc widely varying with temp and a high pour point are set out. The crude line is heated by a hot water line placed in contact with it. E. A. G. H.

1134. Texas Eastern's 15,000-h.p. single-unit stations. F. H. Love. *Petrol. Engr*, 1957, **29** (9), D20–6.—A 15,000-h.p. synchronous electric motor driving a single-stage compressor in a single-unit gas pipeline station is described. Investment costs were lower than for multiple-unit stations.
E. A. G. H.

1135. Progress in tools paces progress in pipelining. F. H. Love. *Petrol. Engr*, 1957, **29** (8), D19–20.—A summary is made of new developments in the construction, maintenance, and operation of pipelines. E. A. G. H.

1136. New station design based on tested equipment and methods. W. W. Holt, Jr. *Petrol. Engr*, 1957, **29** (7), D46–50.—Remotely controlled unattended pumping stations, the design for which was based on operating experience, are described. A teletype circuit for control of smaller pipelines and a microwave system for main lines are used.
E. A. G. H.

1137. Electrical insulation of underground pipelines. G. B. McComb. *Petrol. Engr*, 1957, **29** (7), D38–44.—Tests to determine the water absorptive properties of coatings applied to pipelines are reviewed. Data indicate that the rate of absorption of coal-tar enamels is much less than that of other products. As water absorption by a coating increases, electrical insulation values decrease, so that cathodic protection may become uneconomical. E. A. G. H.

1138. How to analyse the forces that act on river crossings. Pt 2. L. M. Odom. *Petrol. Engr*, 1957, **29** (9), D42–4.—Factors to be considered in the design of pipeline river crossings are mentioned. Methods are given for the prediction of forces caused by currents and turbulence which are frequently troublesome. E. A. G. H.

1139. Engineering underwater river crossings. Pt 1. L. M. Odom. *Petrol. Engr*, 1957, **29** (7), D29–36.—The location of a site for an underwater pipeline river crossing is discussed. Some pipelines are laid in trenches on the river bottom, which must be deep enough to avoid the periodical scouring action of the river exposing the pipe. To avoid flooding hazards the working season should be chosen after study of river hydrographs. E. A. G. H.

1140. Dual control system built into Badger's Middlebury station. A. E. Wooster and J. M. Purvine. *Petrol. Engr*, 1957, **29** (7), D19–21.—Widely divergent pressures and flow rates at a pipeline pumping station and 2 suction sources necessitated the design of a fully automatic system with a manual control system for use when boosting one stream.
E. A. G. H.

1141. River crossing construction methods. D. M. Taylor. *Petrol. Engr*, 1957, **29** (10), D37–49.—Standard techniques and examples of pipeline river crossings are outlined. Variations in methods occur, since each crossing poses individual problems. E. A. G. H.

1142. How mass flowmeters measure gas. L. L. Lawrence, C. M. Halsell, and J. R. MacIntyre. *Petrol. Engr*, 1957, **29** (7), D25–8.—A new meter which measures gas by its mass is described. The gas stream is given a fixed momentum per unit mass by an impeller and then gives up the momentum to a turbine wheel restrained by a torque, which is measured. Greatly improved accuracy in gas metering and large economic savings are claimed for the instrument. E. A. G. H.

1143. New metering concept-vortex velocity type flowmeter. J. C. van Rijn and B. Larys. *Petrol. Engr*, 1957, **29** (9), D27–30.—A new type of flowmeter has been developed which utilizes the linear relationship between the gross vol flow in a pipe and the number of times a constantly maintained vortex, partly in the fluid stream, rotates. Instantaneous readings are obtained which require a single correction to obtain the actual vol flow rate. E. A. G. H.

1144. What you can expect from to-day's P.D. meters. D. C. McKinley. *Pipe Line Ind.*, 1957, **6** (5), 46–53.—An illustrated description of P.D. meters, which give accurate measurements in the 10,000-b.h. range. Performance curves are presented showing accuracy and head loss data for various types of meters handling both crude and products. R. T.

1145. Formation strength in salt cavern storage. D. F. Jahns. *Petrol. Engr*, 1957, **29** (9), B96–101.—Due to explosion hazards in the storage of LPG, underground storage caverns formed by leaching with water should conform to a design allowing a strong cap formation and a suitably shaped cavity. Pear-shaped cavities will accommodate product at higher pressures than other shapes. E. A. G. H.

1146. How gas storage wells behave. Pt 1. C. J. Walker *et al.* *Petrol. Engr*, 1957, **29** (9), D35–40.—Underground gas-storage reservoirs in natural formations were tested during operation. Correlations were determined which enabled the flow rates of several wells to be predicted during withdrawal operations. 17 refs. E. A. G. H.

1147. Distribution of oil in the United Kingdom. Anon. *Petroleum, Lond.*, 1957, **20** (8), 286–9.—The rapidly increasing British demand for oil products from inadequate depots after 1945 necessitated that the distribution system be adjusted. The reorganized Shell-Mex and B.P. system uses large, well-equipped units worked to capacity, minimum handling, and max delivery to the customer. E. A. G. H.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

1148. 1957 inventory of new plants and facilities. Anon. *Chem. Engng*, 1957, **64** (13), 145–69.—569 new plants costing over $200,000 are listed, *ca* 100 of them for petroleum and natural gas products. The inventory lists only plants scheduled or completed in the U.S.A. from July 1956 to Sept. 1957. It details the firm, plant location, products, cost where known, and size and type of plant decided on. P. J. O.

1149. 1957 inventory of new equipment and accessories. Anon. *Chem. Engng*, 1957, **64** (13), 237–475.—420 selected items of new equipment available in the U.S.A. are listed, many having uses in the petroleum industry. The items are classified into the following groups: electrical equipment; feeders and mixers; filters and dust collectors; heaters and coolers; instruments and controls; maintenance tools and supplies; materials of construction; mechanical equipment; packaging and handling equipment; pipe, fittings, and valves; process equipment; pumps, blowers, and compressors; safety equipment. P. J. O.

1150. Design your piping to cut maintenance costs. W. A. Weiss. *Petrol. Refin.*, 1958, **37** (1), 141–6.—Several fundamentals of piping design that will reduce plant maintenance are presented. The selection of piping materials and valves is considered in some detail. Several methods of piping lay-out are considered, including underground and trench piping, pipes on sleepers, and overhead piping. Problems occurring with hot pipes are outlined, the use of computing machines often indicating that fewer loops and elbows and less pipe are required for flexibility. Design factors to be considered for ease of valve maintenance are outlined and methods of provision for pipe and valve replacement discussed. Methods of minimizing pipe vibration are mentioned and ways of reducing insulation maintenance outlined. J. R. T.

1151. How good design reduces maintenance. H. P. Evans and D. Bromley. *Petrol. Refin.*, 1958, **37** (1), 124–8.—Almost every process unit has to be opened up, cleaned, inspected, and repaired at more or less regular intervals. Design can cut maintenance costs by planning for this repetitive work. This article outlines points to be considered in the lay-out of areas, such as provision of paved roads and definite work areas. Process equipment design is considered in some detail, with special reference to heat exchangers and dist columns, and factors to be considered for good maintenance design of such equipment are outlined. Built-in handling methods are also discussed. J. R. T.

1152. Routine inspection of refinery plant. E. J. M. Tait. *Petroleum, Lond.*, 1957, **20** (9), 322–6.—Routine inspection of process plant and equipment has become a major factor in overall efficiency, and a general description of refinery inspection is given. E. A. G. H.

1153. Maintenance organization factors in the modern refinery. C. H. Trotter. *Petrol. Engr*, 1957, **29** (7), C34–41.—Basic factors are described which are employed to provide an optimum maintenance system. In operation the system reduced maintenance costs, increased labour effectiveness, and reduced unit downtime. E. A. G. H.

1154. Custom weed control. D. Evans. *Oil Gas J.*, 20.1.58, **56** (3), 144.—Control of vegetation by new chemical herbicides produced by Du Pont Co. is described. Tables show annual cost analysis/acre and comparison for firebreak around storage tank. G. A. C.

1155. Improve mechanical seals for non-lubricating hydrocarbons. A. L. Decker. *Oil Gas J.*, 6.1.58, **56** (1), 93.—A study was made at Ethyl Corpn's ethyl chloride plant of mechanical seals, and field tests instituted, resulting in a 33% reduction in pump maintenance tests. Basic types of seals, their application, and limitations are described, and selection considerations given. G. A. C.

1156. Concepts in automatic continuous blending: the tools and their uses. L. Lowy. *Petrol. Engr*, 1957, **29** (10), C50–62.—Principles and equipment, suitable for large vol, used in the automatic continuous blending of refinery end products are described. E. A. G. H.

1157. World's largest grass-roots refinery. W. Downer. *Petrol. Engr*, 1957, **29** (7), C6–24.—A new refinery of capacity 130,000 b.d. has been built at Delaware. Process units, several of which are very large, and process operations are described. Maintenance problems are eased by spacious lay-outs, and complex instrumentation keeps process operating manpower at a minimum. E. A. G. H.

1158. The Yorktown refinery. D. A. Mirk. *Petroleum, Lond.*, 1957, **20** (9), 331–5.—A new refinery in Virginia is laid out so that uni-directional flow from incoming crude to outgoing finished products is maintained. The saving in equipment and power is increased by the use of gravity flow along some major lines. E. A. G. H.

1159. Turbocharged two-cycle gas engines. C. A. Chamberlain. *Petrol. Engr*, 1957, **29** (7), C43–4.—Recent development of high efficiency expansion turbines, centrifugal compressors, a hydro-mechanical drive for starting, and low load operation of the turbocharger have made turbocharging 2-stroke gas engines possible. The scavenging air pumps are powered by the exhaust gases. An increase of 33% in b.h.p. resulted. E. A. G. H.

1160. Painting steel structures in petroleum refineries. J. O. Jackson and J. Bigos. *Petrol. Engr*, 1957, **29** (7), C44–6.—Important considerations to ensure good service from paint systems are proper plant design to lessen corrosion and facilitate repainting; preparation of the surface to be protected by pickling or sand blasting; correct application of paint to obtain adequate film thickness; and the use of paints suitable for the required surface. In industrial atmospheres an average paint life expectancy is 7 years. E. A. G. H.

1161. What is ahead for digital computers in refinery process control? C. G. Laspe. *Petrol. Engr*, 1957, **29** (10), C30–8.—Problems of the application of closed-loop digital computer control of refinery operations and future prospects are discussed. 19 refs. E. A. G. H.

1162. Ammonia absorption refrigeration selected for gasoline plant. W. Downer. *Petrol. Engr*, 1957, **29** (7), C25–30.—The ammonia absorption refrigeration process was applied in a low-temp liq recovery plant removing light hydrocarbons from natural gas. Low maintenance cost and simple flexible operation were advantages of the older process. Refrigeration capacity and efficiency remained high at temp approaching −40° F. E. A. G. H.

DISTILLATION

1163. A plant-scale unit for distillation tray research. E. Manning, Jr., S. Marple, and G. P. Hinds, Jr. *Industr. Engng Chem.*, 1957, **49** (12), 2051–4.—To develop tray designs for vapour–liq contacting towers, the Shell Oil Co. has con-

structed a short 5-ft dia column with dist trays for testing the hydraulic behaviour and mass transfer efficiency simultaneously. This was equipped and instrumented for a wide range of operating conditions and was used with an *iso*-octane–toluene test system. A simplified flow diagram is given, and the apparatus and experiments performed are described. The characteristics of a crossflow tray with round bubble caps is discussed, and performance details are given in tabular form. D. K. R.

ABSORPTION AND ADSORPTION

1164. Getting aromatic-free petroleum products by silica gel adsorption method. J. Chachulski. *Bull. Polish Inst. Petrol.*, 1957, **7**, 5–6 (suppl. *Nafta (Krakow)*, 1957, **13**).—The first part of the work aiming at production of the various hydrocarbons, which was undertaken by the Polish IP in 1953, consisted of literature search, the summary of which is now published. In a simplified manner the difference between adsorption of aromatics, on the one hand, and naphthenics and paraffins, on the other, is sufficiently big to permit separation. A schematic diagram is published: from a fraction boiling below 100° C the aromatic components are removed and washed out with technical grade toluene, which is then separated as a result of dist of the eluent. The costs are only 70% of the older method involving the use of oleum. M. S.

SOLVENT EXTRACTION AND DEWAXING

1165. Liquid–liquid flow in packed towers. M. Leva. *Chem. Engng*, 1957, **64** (12), 267–71.—Empirical correlations for flooding of and hold-up in packed towers are discussed, with their limitations. P. J. O.

1166. Aromatic hydrocarbon extraction with solvents. M. el Rifai. *Riv. Combust.*, 1957, **11** (12), 810–40.—The use of triethylene glycol was studied as a solvent of the aromatic hydrocarbons from C_6 to C_8 blended with *n*-heptane. A study of the following 3 ternary systems was made: triethylene glycol–benzene–*n*-heptane; triethylene glycol–toluene–*n*-heptane; and triethylene glycol–ethylbenzene–*n*-heptane. Data are shown on the binodal curves and the conjugated lines. The data obtained were correlated both by means of Othmer and Tobias co-ordinates, as well as with those of Bachmann corrected by Brown. The selective properties of triethylene glycol were compared with those of other selective solvents; in particular, it was possible to determine that triethylene glycol has better selective properties and capacity for extraction than diethylene glycol at low temp.

The equilibrium data at 25° C of the binodal curves and the lines of conjugation for the dipropylene glycol–benzene–heptane and the dipropylene glycol–ethylbenzene–heptane systems are submitted. The plat points have been worked out plotting the equilibrium data on the co-ordinates according to Hand. The object of this investigation is to study the properties of dipropylene glycol (DPG) as a selective solvent of aromatic hydrocarbons from their blends with paraffin hydrocarbons and to obtain further data on the ternary equilibrium in the liq phase. DPG in the pure state reveals little selectivity for aromatic hydrocarbons of low mol. wt. Its selective qualities as a solvent for high mol. wt. aromatic hydrocarbons may be assessed in the course of further experimental work. (Author's abstract.)

1167. Separation of miscible liquids by polymeric absorbents. J. C. H. Hwa, E. F. Meitzner, and C. H. McBurney. *Industr. Engng Chem.*, 1957, **49** (11), 1828–34.—As some solid materials can absorb solvents selectively, so also can some cross-linked polymeric materials. If a mixture of 2 solvents is poured on to one of these polymers, the polymer absorbs the liq, swelling as it does so. If the polymer is selective towards one of the solvents, this will be retained to a greater extent than the other constituent, thus causing a partial separation. If sufficient depth of polymer is available in the form of a column and excess liq is percolated through it, fractionation will occur, giving, under favourable conditions, complete separation. The retained solvent can be extracted from the column by use of a desorbent. Examples of various systems with appropriate polymers are given. D. K. R.

CRACKING

1168. Catalytic reforming at Coryton. Anon. *Petroleum, Lond.*, 1957, **20** (8), 290–3.—A static bed cat reforming process and the equipment used are described for upgrading low-octane naphthas. E. A. G. H.

1169. Reforming—a process for raising the O.N. of motor gasolines. Z. Larocinski. *Nafta (Krakow)*, 1957, **13**, 191–7.—A review of processes available: thermal reforming, polyforming, platforming, catforming, Sinclair–Baker process, Houdriforming, Houdry-Iso-Plus process, Rexforming, and Ultraforming. The Polish petrols have O.N. within the range 51–65. A small fraction from crudes of Austrian origin is *ca* 77–78, while modern requirements are between 80 and 90. TEL is both expensive and toxic. Before any reforming process is started, the raw material has to be closely fractionated, hydrogenated (saturated), desulphurized and denitrogenated, and subjected to fuller's earth treatment. All the reforming processes are briefly described, and whilst the non-cat processes are uneconomical due to excessive losses, Houdry processes are too complicated. Processes based on platinum cat are dependent on supply of uniform crude. The author declares himself in favour of Rexforming with Unifining pretreatment for all fractions suitable as fuels. M. S.

1170. Catalyst erosion in cat crackers. L. Resen. *Oil Gas J.*, 23.12.57, **55** (51), 61.—This is pt 2 of a series, and deals with erosion in cat carrier line, flue gas stack and lines, and the aeration system. Problems are stated and solutions indicated. G. A. C.

1171. How Vickers boosted package TCC capacity 50 per cent. S. Valentine and T. B. Arnold. *Petrol. Engr*, 1957, **29** (9), C17–19.—A packaged TCC unit was increased in capacity at low cost by modified hot cat storage and a revision of cat circulation. E. A. G. H.

1172. New cracking process for acetylene and ethylene. G. A. Akin, T. F. Reid, and R. J. Schrader. *Oil Gas J.*, 13.1.58, **56** (2), 78.—A new pyrolysis process is described, developed by Tennessee Eastman Co., utilizing light saturated hydrocarbons for production of acetylene and ethylene. Relatively high heat is necessary for the reaction, and gases therefrom are dealt with by the hypersorption and selective absorption processes to produce pure products.

Tables give basic data obtained when cracking propane and natural gas. G. A. C.

1173. Regenerator heat-balance calculation. O. A. Wounderuch and F. E. Ivey. *Oil Gas J.*, 20.1.58, **56** (3), 121.—A relation is graphically shown of the variables which control regenerator heat balance. Authors demonstrate that the cracking cat has a direct influence on the dependent variables CO_2/CO ratio and quality of coke burnt, and indirectly on the independent variables of air rate, regenerator bed temp, and cat circulation rate through the coke burning rate of the cat. Charts are provided. G. A. C.

HYDROGENATION

1174. Batch hydrogenolysis reactions of pure compounds related to petroleum oils. E. B. Shultz, Jr., and H. R. Linden. *Industr. Engng Chem.*, 1957, **49** (12), 2011–16.—In view of the increasing importance of natural gas as a power source, the pyrolysis of liq fossil fuels in the presence of hydrogen is being investigated with a view to the production of natural gas substitutes. Conventional methods, at atm pressure and without additional hydrogen, produce much coke and many liq by-products with little gas of high olefin content. The experiments reported indicate that at 1200°–1350° F and 2000–4400 p.s.i. and with suitable hydrogen oil feed rates, dist and residual petroleum oils could be converted at high rates to gases containing 90 mol % methane with little solid or liq products. The thermal hydrogenolysis of several pure hydrocarbons related to petroleum was also studied. A description of the apparatus and procedure used is given, and tables of results showing the recovered components from batch hydrogenolysis of *n*-paraffins, cyclic C_6- and C_{10}-hydrocarbons, and technical ethane are given. D. K. R.

1175. Hydrogenating coal at 800° C. R. W. Hiteshue, R. B. Anderson, and M. D. Schlesinger. *Industr. Engng Chem.*, 1957, **49** (12), 2008–10.—Experiments are described which were designed to find the effect of a short residence time at 800° C and 6000 p.s.i. on hydrogenation of a bituminous C coal from Wyoming, using ammonium molybdate with sulphuric acid as cat. A reactor with a short heating and cooling cycle is described, and details of the procedure used are given. At a residence time of 1 minute, 48% of the coal was converted into gaseous hydrocarbons and *ca* 10% to aromatic oils. Increased residence time increased conversion without changing the oil yield. D. K. R.

1176. Making butadiene. 3. Dehydrogenation uses fixed-bed methods. J. C. Reidel. *Oil Gas J.*, 9.12.57, **55** (49), 114.—The steam-dilution method for butylene dehydrogenation, the Houdry adiabatic process, and the Phillips isothermal process are current methods. Future processes may employ fluid-bed and moving-bed techniques. The tie-in between the steam-dilution method and the Houdry adiabatic or Phillips isothermal butane dehydrogenation is explained. G. A. C.

1177. Hydrogen treating in the refinery. Pt 1. P. W. Sherwood. *Petroleum, Lond.*, 1957, **20** (8), 281–4.—Hydrogen treating at moderate pressure is gaining considerably in importance. A more stable product and a highly saturated recycle stock, giving good yields on cat cracking, are obtained. The effects of process variables on results are reviewed. Details are given of 2 processes, Autofining, intended for simultaneous desulphurization and reforming, and the Trickle process, operating with mixed phase in the reactor. E. A. G. H.

SPECIAL PROCESSES

1178. Synthesis of propionic anhydride and propionic acid. R. E. Brookes *et al.* *Industr. Engng Chem.*, 1957, **49** (12), 2004–7.—The industrial manufacture of organic acids and anhydrides has been retarded by the need, in many cases, for corrosive cat or expensive reagents. Lab studies reported here show that non-corrosive nickel carbonyl acts as an effective cat in the synthesis of propionic acid from ethylene, carbon monoxide, and water, and of propionic anhydride from ethylene, carbon monoxide, and propionic acid. Conversions and yields in small test vessels at 300–800 atm pressure at 300° C were promising enough to justify more detailed study in semi-works apparatus and continuous flow conditions. Graphs of the effects of pressure, temp, and residence time on percentage conversion are given. D. K. R.

1179. Isomer distribution in the Oxo reaction. V. L. Hughes and I. Kirschenbaum. *Industr. Engng Chem.*, 1957, **49** (12), 1999–2003.—Experiments were performed to determine the factors controlling isomer distribution in the Oxo process and to find the best method of preparing an alcohol of mono-isomeric composition. Process variables investigated included temp, pressure, hydrogen–carbon monoxide mol ratio, cat conc, and olefin type. Results show that the percentage of straight-chain alcohol or aldehyde in the reaction product can be controlled within limits by the choice of operating conditions. Tables of results are given and discussed. D. K. R.

1180. Separation of benzene and *n*-heptane in continuous thermal diffusion columns. T. S. Heines, O. A. Larson, and J. J. Martin. *Industr. Engng Chem.*, 1957, **49** (11), 1911–20.—A description is given of the operation of continuous thermal diffusion columns used to separate liq mixtures of benzene and *n*-heptane. Operating data, calculation of results, and correlating equations are given. The effect of varying such quantities as column height, feed rate, spacing, feed composition, and temp gradient, and the separation obtainable has been studied, and the results obtained are given in graphical form. D. K. R.

1181. Gas making processes in the British gas industry. K. J. Crane. *J. Inst. Fuel*, Dec. 1957, **30** (203), 661.—The changes occurring in the gas industry are outlined. Combined dist and gasification processes at atm pressure are being developed to utilize weakly caking coals. Cat oil gas processes have been developed, which in addition to producing a satisfactory town gas from medium and heavy fuel oils, may also be used to reform refinery tail gases. Natural gas is still being sought and the prospect of importing gas in liquefied state is being investigated. The coke situation is also discussed. 7 refs, 2-page appendix, 2 pages of discussion. D. K.

1182. The Koppers-Totzek gasification process. H. H. Koppers. *J. Inst. Fuel*, 1957, **30** (203), 673.—The installation and operation of a plant suitable for the gasification of all types of fuel is described. Operating results are given for a Finnish plant. The gasification of both coal dust and heavy oil is dealt with. 3 refs, 5 pages of discussion. D. K.

METERING AND CONTROL

1183. Automatic service control in chemical operations. (In German.) B. Waeser. *Chem. Zeitung*, 1958, **82** (2), 37–45.—The principles and operation of automatic control for chemical operations are reviewed. Details are given of control mechanisms for a number of operations. P. J. K.

PRODUCTS

CHEMISTRY AND PHYSICS

1184. Thermal conductivity of propane. D. E. Leng and A. W. Comings. *Industr. Engng Chem.*, 1957, **49** (12), 2042–5.—The thermal conductivity of propane was measured using a concentric gas layer type of cell for temp from 122° to 284° F and for pressures from 1 to 280 atm. The results obtained failed to agree with the generalized correlation for the thermal conductivity of gases proposed by Lenoir, Junk, and Comings, and anomalies were observed in the critical region. This deviation is discussed and a possible explanation proposed, together with a correlation based on molecular complexity. D. K. R.

1185. How transport data accuracy affects design. L. Friend and S. B. Adler. *Petrol. Refin.*, 1958, **37** (1), 191–3.—Visc, thermal conductivity, and mass diffusivity are the most useful properties for the design of equipment for fluid flow, heat transfer, and dist. Accuracy in the process design calculations is only as precise as the data used. This article discusses the requirements of accuracy in each of the above properties and illustrates the effect of visc on pressure drop, the effect of visc and thermal conductivity on heat transfer, and the effect of diffusivity and visc on the Murphree point efficiency. J. R. T.

1186. Liquid–liquid equilibria at 20° C. Y. L. Gladel and P. Lablaude. *Rev. Inst. franç. Pétrole*, 1957, **12**, 1236–40.—Equilibrium diagram and data are presented for the system propylene carbonate, n-C_7H_{16}, toluene, at 20° C. Although ethylene carbonate has greater selectivity for aromatics, the propylene cpd, which has a much lower m.p., can be used at lower temp. W. A. M.

1187. Determine heat of vaporization. W. R. Gambill. *Chem. Engng*, 1957, **64** (12), 261–6.—The author discusses first the application of the Clapeyron equation in rigid and approx forms, indicating where the necessary data may be found. The more general methods proposed by Haggenmacher, Thomson, Klein and Kharbada, Meissner, Kistyakowsky, Landee, and Whittier are then discussed, with some indication of the limitations and accuracy of each. Trouton's rule and Maxwell's data on paraffin hydrocarbons are also given. P. J. O.

1188. Enthalpy and entropy data for hydrocarbon mixtures. M. Hobson and J. H. Weber. *Chem. Engng*, 1957, **64** (12), 272–4.—After describing the use of reference states, and partial quantities (partial vol, enthalpy, etc.), the authors discuss methods of determining the thermodynamic properties of a mixture. Weighted summation of pure component properties is suitable for mixtures at high temp and moderate pressure; refinements for more difficult conditions include the equivalent pure component method, used alone or in conjunction with partial enthalpy correlations or generalized charts of thermodynamic properties. P. J. O.

1189. Flames and industry. J. H. Burgoyne. *Nature, Lond.*, 1958, **181**, 15–17.—Report of a symposium held in London, Oct. 1957. Among the topics discussed are the work of the International Flame Research Association at Ijmuiden, including description of furnaces and ancillary apparatus, application to oil-fired furnaces, pulverized coal flames, and gas turbine combustion chambers. Kinetic studies of oil and gas flames, and methods of evaluating the non-luminous radiation and emissivity of combustion products are described. H. C. E.

1190. Rotation viscometer directly measuring the ratio of the shearing stress to the rate of shear. H. Eisenberg. *Rev. sci. Instrum.*, 1957, **28**, 927–9.—A rotation viscometer, directly measuring the ratio of the shearing stress to the rate of shear, is described in detail. A slit, the width of which is proportional to the shearing stress, rotates together with the rotating cyl of the viscometer; a narrow beam of light passes through this slit and falls on a photoelectric cell; the time of illumination of the photoelectric cell is proportional to the visc. The reading for Newtonian liq is independent of the speed of rotation, and for non-Newtonian liq gives a direct indication of the dependence of the apparent visc on the rate of shear. The instrument may be used over a wide range of visc and rates of shear. (Author's abstract.)

ANALYSIS AND TESTING

1191. Sohio finds analogue computers ideal for process analysis. W. Jackson, Jr. *Petrol. Engr*, 1957, **29** (10), C41–6.—Simulation of a refinery process mathematically using a computer permits rapid, flexible, and more detailed calculation. E. A. G. H.

1192. Continuous analysers—key to process automation. H. J. Noebels. *Petrol. Engr*, 1957, **29** (10), C24–9.—Automatic quality control is now possible using continuous stream analysers which provide accurate analytical information for optimum process operation. Various types and applications of analysers are mentioned. E. A. G. H.

CRUDE OIL

1193. De-acidification of crudes. J. Marciniak and S. Sukranowski. *Nafta (Krakow)*, 1957, **13**, 252–4.—Whilst working on Austrian crudes which have ½% S and 0·01% Cl corrosion of installation has been observed. Acid No. of this crude was 1·2–1·8, and damage was extensive. Experimental work was initiated in order to reduce these figures and using NaOH in a countercurrent washing, acid No. was reduced to 0·0%, although traces of acids remained, capable of determination by more accurate methods. After dist some fractions were found to contain more acid than others, in particular the 360°–420° C cut. Demulsification of the crude presented formidable problems, but a higher concn of NaOH gave not only better neutralization, but also a lower quantity of water-in-oil phase. The aq phase, when treated with HCl, would precipitate the naphthenic acids and by salting out with NaCl bitumen could be pptd. M. S.

GAS

1194. Hydrocarbon reforming in relation to town gas supply. A. R. Myhill. *Petroleum, Lond.*, 1957, **20** (8), 301–5.—The increasing demand for town gas in the U.K. has created a problem of obtaining adequate raw material. Suitable hydrocarbon gases from petroleum provide an alternative source. The cal. val. and burning properties of the hydrocarbons are altered by reforming processes to suit existing equipment and legal requirements. E. A. G. H.

1195. Natural gas in Scotland. T. S. Ricketts and D. C. Elgin. *Nature, Lond.*, 1957, **180**, 1444.—The geological formation at a natural gas field in Midlothian is described. Due to the disturbed nature of the geological structure, accurate estimates of the gas reserve cannot be made, but a value of 10^9 cu. ft. is considered likely. The gas has a calorific value of 930–960 B.t.u/cu. ft., and comprises *ca* 90% methane, 3% ethane, and 1% propane; the remainder is mainly nitrogen, with no sulphur cpds. It is drawn from the field at 600 p.s.i.,

and pressure is reduced to 3 p.s.i. in 3 stages. It is then piped 4 miles to Musselburgh and mixed with coal gas for domestic use. H. C. E.

1196. Liquefied natural gas. Pt 1. C. I. Kelly. *Petrol. Times*, 31.1.58, **72** (1578), 84.—The first of a series of articles outlines the present position regarding the intention of Gas Council of importing liquefied natural gas. The problem and the possibility, European interest, other points of view, a Gas Board's opinion, and the Gas Council's policy are discussed. G. A. C.

ENGINE FUELS

1197. Dualayer gasoline process to remove mercaptans. B. F. Greek, C. A. Duval, and V. A. Kalichevsky. *Industr. Engng Chem.*, 1957, **49** (12), 1938–44.—Because of their strongly deleterious effect on the TEL response, it is of commercial interest to remove mercaptans from gasoline of high octane rating. 2 methods are available: conversion of the mercaptans to disulphides, which are, however, equally damaging in this context, or their removal by suitable chemical reagents. In the Dualayer process, an example of the latter method, gasoline and a caustic–organic acid soln are contacted in the liq phase, the mercaptans dissolving in the treating soln. As gasoline and this soln are immiscible, they can be separated without difficulty. A full report of the theory and operation of the process, with description of the apparatus, a flow sheet, phase diagram, and visc curves for the Dualayer treating soln is given. D. K. R.

1198. Spectroscopic investigation of *n*-heptane preflame reactions in a motored engine. K. J. Pipenberg and A. J. Pahnke. *Industr. Engng Chem.*, 1957, **49** (12), 2067–72.—An account is given of experiments where a spectrometer was geared to a single-cyl engine and used to study the chemical reactions which cause the cool, blue, and intense blue flames occurring in an engine combustion chamber as the load is progressively increased. Evidence was found that these reactions progressively involve more degradation and oxidn of the fuel. Reactions involving hydrocarbon decomposition and the formation of carbonyl cpds are associated with the cool flame, while those associated with the blue and intense blue flames involve further oxidn of the carbonyl cpds. Under intense blue flame conditions, free radical reactions occur, which tend to give auto-ignition and knock. Many graphs of ignition spectra are given and interpreted, and the case where TEL is added to the fuel is considered. This is thought to lead to a slowing-down of the carbonyl decomposition under blue flame conditions, possibly by deactivating free radical intermediates. D. K. R.

1199. Butadiene and aviation gasoline go hand-in-glove. D. M. Taylor. *Petrol. Engr*, 1957, **29** (9), C13–16.—High thermal efficiency and operational flexibility are obtained from a combination of 2 processes making butadiene by hydrogenation and aviation gasoline by alkylation. E. A. G. H.

1200. Gasoline from mineral oil. Anon. *Petrol. Engr*, 1957, **29** (10), E18–20.—An asphaltite ore from deposits in Utah and Colorado is being refined into a high octane gasoline and metallurgical coke. The ore is mined by using jets of water to remove explosion hazards and is conveyed to the refinery as a slurry in a pipeline over mountainous country. E. A. G. H.

1201. Molecular sieves boost octane ratings of light naphtha and reformate. W. C. Ziegenhain. *Petrol. Engr*, 1957, **29** (9), C6–12.—Lab results indicate that the use of mol sieves increases the O.N. of cat reformate sufficiently to make the process attractive commercially. E. A. G. H.

1202. Differences in road and laboratory octane numbers. E. S. Corner. *Petrol. Engr*, 1957, **29** (7), C54–9.—An equation giving correlations between road O.N. of gasolines and their lab O.N. is derived and its applications discussed. Modern trends indicate that the Motor O.N. requirement of engines is increasing, and at high speeds data show that increasing the Motor O.N. increases available power to only a small extent. E. A. G. H.

1203. Research on synthesis of liquid fuels. C. Ta-yu, L. Nan-Tsuen, and C. Chun-Hao. *Petroleum, Lond.*, 1957, **20** (9), 336–40.—Pilot-plant data using a nitrided fused-iron cat were obtained on the synthesis of liq fuels from carbon monoxide and hydrogen using a fluidized process. Good operability was realized at a fair selectivity level. The addition of potassium carbonate to the cat increased the proportion of higher mol. wt. cpds in the product. The gasoline fraction produced had a fairly low octane rating and required the addition of TEL to raise the rating to a suitable value for a motor fuel. A cobalt cat for the reaction was also investigated. The surface complex of Si and Co was found to be related to the cat quality. E. A. G. H.

LUBRICANTS

1204. Lubrication and wear. D. Tabor. *Nature, Lond.*, 1957, **180**, 1448–51.—Report of a discussion held in London, Oct. 1957. It contains 4 main sections: hydrodynamic lubrication; friction and boundary lubrication; bearings, ball bearings, and I.C. engines; and wear.

(1) Classical theories of hydrodynamic lubrication do not explain cavitation studies of the film at low pressure. The hydrodynamic region extends much farther than was earlier considered likely, and the next few years will probably see further applications involving very thin " marginal " hydrodynamic lubrication.

(2) Evidence suggests that friction of metals is largely due to local adhesions, but there may also be " ploughing " of one surface by another. With elastic materials, such as rubber, the friction due to lubricated sliding is largely due to elastic hysteresis losses in the rubber; these losses are of importance generally in the friction and fatigue of sliding and rolling surfaces. At extremely high sliding speeds (~ 2000 ft/sec) the friction falls to a low value due to the melting of the surface layers, although some metals behave in a brittle fashion and surface disintegration occurs. The purpose of a boundary lubricant film is to reduce welding between surfaces; suitable materials are fatty acids, sodium soaps, metal sulphides, and chlorides, or certain lamellar solids.

(3) Many bearing materials, comprising metals impregnated with graphite, MoS_2, polytetrafluoroethylene, etc., operate in the absence of lubricants. Phosphate coatings apparently function by enabling high spots to be safely removed. It is still uncertain whether gear lubrication proceeds under hydrodynamic or boundary conditions. Lubrication of ball bearings and I.C. engines was also discussed, as was lubrication in the presence of nuclear radiation. Although aromatics are the more radiation-stable, they are, of course, less thermally stable, and a compromise must be reached.

(4) Among the subjects discussed in this section were oblique or taper sections for examining subsurface damage, high-resolution interferometry, micro-hardness tests, electron microscopy, electron diffraction, and isotope techniques. Wear due to cavitation, impact, corrosion, and fretting was discussed. Lubricants are used primarily to reduce wear and only secondarily to diminish friction. H. C. E.

1205. Metal cutting research. Some activities of the Production Engineering Research Association. Anon. *Auto. Engr*, 1957, **47** (11), 449.—A short survey is given of some

researches into cutting tools carried out by PERA, together with some examples of research results. Brief mention is also made of investigations on machine tools and cutting fluids.
D. K.

1206. Lubrication of highway construction equipment. Anon. *Lubrication*, 1958, **13**, 149–64.—Progressive improvements in road construction in the U.S.A., dating from invention and immediate public acceptance of the automobile at the beginning of the century, are traced. Present production of faster, bigger motor vehicles imposes a severe load on the highway system, designed years ago to accommodate the existing traffic, but inadequate for current requirements. While the highway system has not kept pace with automotive production and use, for 30 years equipment manufacturers have built bigger, better-designed units for every phase of road building. Proper lubrication is vital to successful and economic operation of all equipment. High-quality lubricants have been developed to protect moving parts of every equipment type under the most severe operating conditions encountered. Compromising with lubricant quality is false economy, lubricant cost being negligible compared with equipment cost. Operating costs can be reduced to a minimum by adopting a simplified lubrication plan as presented, and keeping the No. of lubricants to a minimum. Storing, handling, and lubricant application require careful control. Strict observance of a lubrication and preventive maintenance plan is essential. R. T.

1207. Chemical products as additives to lubricants. (In German.) R. S. Aries and A. P. Sachs. *Erdöl u. Kohle*, 1956, **9**, 775–8.—Every lub oil type requires a sp additive to impart definite properties. Chem lubricant additives are discussed with ref to their effect on sp essential properties. A list of producing firms and their products is presented. R. T.

1208. Investigations on the film resistance of lubricants in the roller bearing in dependence on load and rev/min. Pt 3. Discussion of test results. (In German.) E. Terres, G. Morlock, and K. H. Völker. *Erdöl u. Kohle*, 1956, **9**, 770–5.—The lubricating behaviour of the oils is explained well by Vogelpohl's extended mechanics. In contrast the usual data—V.I., fl. pt., Conradson, etc., and group analysis do not permit recognition of any regularity for the film strength. The relationships are still more complicated when oils containing additives are considered. It is true, probably, that the mol size, which runs in the same direction as the visc, is of decisive importance for the lubricating behaviour. These influences, as also adhesiveness, are not grasped from the mechanics and are possibly the cause of the deviations by 10% of the val registered in the table presented. R. T.

1209. Influence of detergents on dispersing properties of lubricants. S. A. Kreyn *et al.* *Nafta (Krakow)*, 1957, **13**, 217–20.—The purpose of introducing detergents is to prevent the formation of large particles of sediments. Tests are conducted in a centrifuge, which shows that Stokes' law is not obeyed even by natural oils. These contain dispersants of natural origin. Various doped oils were examined for sedimentation, and their properties are tabulated. M. S.

1210. Gear lubricants. American developments for hypoid axle arrangements. Anon. *Auto. Engr*, 1957, **47** (11), 463.—A brief review. Aspects considered are: new products, reference gear lubricants, dirt, deterioration, gear lubricant change, future problems. D. K.

1211. The problem of automobile gear lubricants. C. J. Boner. *Petrol. Engr*, 1957, **29** (10), C64–8.—Increasing engine h.p., car weights, rear axle temp, and decreasing car heights have necessitated the development of a new high-quality gear lubricant. If the trends continue it is suggested that a fluid clutch or hydraulic coupling may be used instead of gears.
E. A. G. H.

1212. The viscosity–temperature relationship of lubricating oils. E. G. Ellis. *Petroleum, Lond.*, 1957, **20** (8), 294–8.—Lub oils are used over a range of temp, so that the visc–temp relationship is important. Methods for the determination of the relationship are reviewed, but limited knowledge of the theory has prevented the development of any fundamental expression. Improvements in lubrication have revealed the disadvantages of present methods. 18 refs. E. A. G. H.

1213. Pilot plant for the synthesis of anti-oxidant, anti-corrosive additive. H. Mosurski. *Bull. Polish Inst. Petrol.*, 1957, **7**, 6 (suppl. *Nafta (Krakow)*, 1957, **13**).—Following the success with glass apparatus, pilot plant work has been successfully done at the Polish IP on terpene-based additive: P_2S_5 in lub oil suspension is added to terpene in the same oil at 110°–150° C over 40–60 min, and reaction goes on for an hour more. The reaction mixture is decolorized and filtered. Excess terpene is evaporated off. The yield is 75–80%. M. S.

1214. Automatic grease-dispensing equipment. Anon. *Lubrication*, 1958, **13** (2), 165–76.—The hand lubrication system—uneconomical in time and material—leaned too heavily on the human factor. Centralized systems constitute a transition from hand to automatic lubrication. For automatic operation 2 basic types—the series and the parallel systems—are explained. Numerous designs of automatic grease-dispensing equipment, available for lubricating industrial equipment, are discussed. Present-day machinery speeds and precision are due largely to automatic lubrication systems. Choice of the proper lubricant—essential for satisfactory operation—is aided by the controlled lab tests described for obtaining performance data of greases in automatic systems.
R. T.

SPECIAL HYDROCARBON PRODUCTS

1215. Gas filled transformers vie with oil filled. Anon. *Elect. World*, 1957, **148** (24), 72.—Transformers using SF_6 as an insulating and cooling medium compare favourably with oil-filled transformers, and can be built for any load or voltage rating. Little maintenance is required, except for gas leaks at pressure switches. P. J. K.

1216. Dielectric losses in transformer oils. (In German.) K. Potthoff. *Electrotech. Z.*, 1957, **78**(A), 881–3.—The dielectric loss in transformer oils increases more or less with the age of the oil. The increase is a linear function of the oil composition. There is a marked difference between aromatic oils and ones with a different percentage of carbon atoms with double bonds. Oil with a higher aromatic content gave a faster rise in the loss factor (tan δ) than oil with a negligible aromaticity.
P. J. K.

DERIVED CHEMICAL PRODUCTS

1217. Petrochemicals to keep pace in '58. R. Katen. *Petrol. Refin.*, 1958, **37** (1), 179–84.—A review of the petroleum chemical industry is presented which includes an examination of the growth in annual production of the major petroleum chemicals since 1953. Production of many of the earlier spectacular cpds has steadied down to a fairly stable market with only a moderate rate of growth. There is still rapid growth in some fields, particularly those products which are primary materials for plastic and synthetic fibre use, but new process developments result in fairly rapid obsolescence of even relatively new facilities. Raw materials are still the major controlling factor in the economics of petroleum chemical production, and further development of the trend

towards centralized distribution facilities for the basic building units should be observed in the near future, particularly in the case of gaseous feeds such as propylene and acetylene. Another trend may also be observed in the use of improved types of gas oxidn and reforming units to supply synthesis gas for some of the more complex products such as the higher fatty acids, alcohols, and aldehydes. J. R. T.

1218. Hydrogen peroxide—petrochemical newcomer. Pt 1. P. W. Sherwood. *Petrol. Engr*, 1957, **29** (9), C22–30.—The manufacture by the alkyl anthraquinone process and applications of hydrogen peroxide in various industrial oxidn processes are outlined. E. A. G. H.

MISCELLANEOUS PRODUCTS

1219. 1957 inventory of new chemicals and raw materials. Anon. *Chem. Engng*, 1957, **64** (13), 171–235.—242 new chemicals and materials available in the U.S.A. are listed, including agricultural chemicals, bonding agents, lubricants, maintenance chemicals, organic chemicals, protective coatings, pulp and paper chemicals, resins and plastics, rubber and rubber chemicals, surface-active agents, textile chemicals and synthetic fibres, and miscellaneous chemical products. P. J. O.

1220. Organometallics in ethylene polymerization. H. N. Friedlander and K. Oita. *Industr. Engng Chem.*, 1957, **49** (11), 1885–90.—It is suggested that an understanding of the part played by organometallics in the preparation of highly crystalline polyethylene by low temp techniques may help in discovering the mechanism of this process. Some experimental work on this subject is described, and a plausible mechanism connecting the organometallics with the cat reaction is proposed. D. K. R.

1221. Promoted molybdena–alumina catalysts in ethylene polymerization. E. Field and M. Feller. *Industr. Engng Chem.*, 1957, **49** (11), 1883–7.—In the polymerization of ethylene over molybdena–alumina, regeneration is normally required periodically. This need can be almost eliminated by the use of electropositive metals and their oxides as promoters. Many promoters were tested, and the production per cycle was increased by up to 180-fold of that using the unpromoted cat. The promoters operate by activating fresh cat at polymerization temp, scavenging and deactivating impurities such as water, carbon dioxide, and sulphur cpds present in the system, and also entering directly into the cat processes. D. K. R.

1222. Solid catalysts in ethylene polymerization. E. F. Peters, A. Zletz, and B. L. Evering. *Industr. Engng Chem.*, 1957, **49** (11), 1879–82.—The cost of high pressure polymerization of ethylene has encouraged interest in low pressure methods of making polyethylenes over solid cat. The cat activity of metals and metal-oxides on various supports was investigated in several combinations. Special investigation was made of the use of nickel–charcoal and molybdenum–alumina cat for ethylene polymerization in batch and flow reactors. The effects of relevant variables on the yields and properties of the product were studied, as was also the reactivation and regeneration of the cat in a flow reactor. The low pressure polyethylenes were found to be much tougher and have a higher crystallinity than those produced by the high pressure method. D. K. R.

1223. Delayed coke cuts generating fuel cost. J. M. McGurn. *Elect. World*, 1958, **149** (2), 64.—Delayed coke, mixed with coal, fuels a specially designed 150-MW unit at Virginia Electric and Power Co's Yorktown power station. Cheaper fuel costs offset slightly poorer heat rate and charges for special design. A normal firing rate of 50% coke, 50% coal is maintained. Delayed combustion has been noticed, and this leads to difficulties in maintaining rated superheat and reheat temp. Air pollution from coal and coke operation and fly ash from the stack have been a nuisance. P. J. K.

CORROSION

1224. An electrical resistance technique for measuring the corrosivity of naphtha streams. W. L. Terrell and W. L. Lewis. *Corrosion*, 1956, **12** (10), 491–4t.—A rapid, highly-sensitive lab test for measuring low corrosion rates in naphtha streams is described. The method uses the change in electrical resistance of a steel shim during exposure to the corrosive medium. Reproducible results may be obtained in a 6-hr test. Results given by this method are compared with those obtained from retractable coupons. F. M. G.

1225. Casing corrosion in the Hugoton gas field. W. C. Koger. *Corrosion*, 1956, **12** (10), 507–12t.—In a survey of casing leaks in the Hugoton gas field it was found that, although leak frequency was relatively low, leaks usually resulted in lower production or loss of the well, due to damage to the producing formation by the entry of sand and water through the leaks.

The indications are that sufficient current to protect the wells may be obtained from sacrificial anodes. The problem of interference from rectifier installations in the field is discussed. F. M. G.

1226. Calculation of the pH of oil well waters. W. F. Rogers. *Corrosion*, 1956, **12** (12), 595–601t.—The investigation of the effect of acidity on corrosion in oil well waters requires a knowledge of down hole pH values. A technique for calculating the dissolved carbon dioxide in well water, and hence the pH value, is given. The method is not exact, but is believed to give a close approximation. F. M. G.

1227. How epoxies can simplify maintenance. E. R. Scogin and H. W. Howard. *Petrol. Refin.*, 1958, **37** (1), 152–4.—Epoxy resins, properly formulated into coatings and applied, are simplifying corrosion maintenance problems and cutting financial losses due to atmospheric and chemical corrosion in refineries. This article outlines the 4 main classes of commercial significance, namely, epoxy-amine, epoxy-esters, epoxy-phenolics, and epoxy-ureas, and discusses the application of each class to corrosion problems. The surface coatings based on these resins are suited for this purpose because of their versatility and the combination of the properties they exhibit, namely, excellent adhesion, flexibility, toughness, and chemical resistance. Several other types of coating are discussed, and a comparison is made between these and the epoxy resins with reference to their chemical, physical, and application properties. J. R. T.

1228. Naphthenic acid corrosion—an old enemy of the petroleum industry. W. A. Derungs. *Corrosion*, 1956, **12** (12), 617–22t.—Naphthenic acids become active at high temp without the necessity of the presence of water. Differentiation between naphthenic acid corrosion and sulphur cpd corrosion is possible by the observation of the effects on steel. In the case of mild steel naphthenic acid attack starts at 220° F and increases to a max, often at 520°–535° F, after which it decreases while sulphur attack increases. No naphthenic acid attack is evident above 750° F. The corrosion is characteristic, and usually takes the form of sharp-edged holes or

streamlined grooves, and the scale is easily dissolved and washed away by hot oil. Factors increasing corrosion rates include high turbulence (often with impact), high volatility, reduced pressure, and the presence of steam. Principal methods of protection are the removal of the acids by pretopping at relatively low temp or by neutralization by lime or caustic soda, and a proper selection of materials of construction. Properties of materials are compared, and one of the most resistant and useful is found to be 18 Cr–8 Ni–3 Mo steel. Aluminium is not attacked, but its use is restricted due to its other properties, and copper and copper alloys are badly attacked. F. M. G.

1229. Properties, specifications, tests, and recommendations for coal tar coatings. Pt I. Hot applied coatings. W. F. Fair, Jr. *Corrosion*, 1956, **12** (11), 579–87t.—Up-to-date information on the properties, use, and specification testing of hot applied coal tar coatings is given.

Unplasticized coal tar enamels are more resistant to prolonged contact with petroleum products than plasticized enamels, but both are superior to other bituminous coatings. F. M. G.

1230. Use of baked coatings in the oil, chemical, and processing industries. G. J. Duesterberg. *Corrosion*, 1956, **12** (11), 576–8t.—Thermosetting coatings are discussed, and examples are given of their use in industry for corrosion prevention, protection from product contamination, and reduction in solid growth. F. M. G.

1231. A simple phase equilibrium approach to the problem of oil-ash corrosion. W. R. Foster, M. H. Leipold, and T. S. Shevlin. *Corrosion*, 1956, **12** (11), 539–48t.—A compatibility diagram for the ternary system Na_2O–SO_3–V_2O_5 is deduced and its essential validity confirmed. This diagram is used to analyse the results from present and previous oil-ash corrosion research, and this leads to considerable clarification of the role of Na_2SO_4–V_2O_5 mixtures in corrosion. F. M. G.

1232. Laboratory method for corrosion inhibitor evaluation. G. A. Marsh and E. Schaschl. *Corrosion*, 1956, **12** (11), 534–8t.—A lab method for evaluating gasoline rust inhibitors has been devised, as the ASTM D–665–54 turbine oil rust test has been found to be unsatisfactory for this purpose. The method is quantitative and adaptable to other multi-phase corrosion systems, and close temp control is unnecessary. Lab and tanker results are compared. F. M. G.

1233. Effect of sulphide scales on catalytic reforming and cracking units. E. L. Hildebrand. *Corrosion*, 1956, **12** (10), 73–6.—Pt 1. The difference between high temp sulphide attack on steel in cat reformers and sulphur corrosion in certain other refinery processes is thought to be due to the presence of: (*a*) an entirely gaseous hydrocarbon phase; (*b*) a substantial quantity of hydrogen sulphide (instead of most of the sulphur being present as organic sulphur cpds); and (*c*) a large amount of hydrogen gas.

The corrosion downstream of the first reactor is compared with that in the reheat section and in other units. The attack after the first reactor takes the form of heavy scaling and intergranular penetration. A theory for the mechanism of this attack by H_2S–H_2 is suggested.

Pt 2. Sections of 18–8 Cr–Ni plate lines in fluid cat cracking unit failed a few months after operations began, due to intergranular corrosion which first occurred under carbon steel wear plates. The failure was found to be due to a corrosive medium created from moist sulphide scale.

A refractory lined spent cat hopper and stripper was found to be cracked round nearly every welding stud and scab patch, and this columbium-stabilized steel was found to have both intergranular and transcrystalline cracks.

A procedure which, it is believed, will prevent sulphide scale hydrolysis corrosion of 18–8 furnace tubes is recommended. F. M. G.

1234. Statement of minimum requirements for protection of buried pipelines. NACE Technical Group Cttee T–2. *Corrosion*, 1956, **12** (10), 479t.—A special task group of NACE Technical Group Cttee T–2 on Pipeline Corrosion has prepared a statement on "Minimum Requirements for Protection of Buried Pipelines," which recommends that: (1) All underground steel piping should be coated with a protective material of permanent high electrical resistivity. Such coatings, if not so compounded as to resist soil stresses, shall be shielded in such manner as to receive negligible damage from such stresses. (2) The coated piping shall be further protected from external corrosion by supplementing the protective coating mentioned in (1) with adequate cathodic protection. F. M. G.

1235. Catalyst corrosion in cat crackers. III. Anon. *Oil Gas J.*, 6.1.58, **56** (1), 106.—Practically all parts of the cat-carrying system are dealt with in a case-history of a number of erosion problems, and solutions are given. G. A. C.

1236. High temperature hydrogen sulphide corrosion in commercial Sovaformer units. Pt 2. E. B. Backensto, R. D. Drew, and J. N. Vlachos. *Corrosion Tech.*, 1958, **5** (2), 53–6.—Corrosion test results obtained in a second Sovaformer—a fixed-bed reformer using a Pt-type cat—at Augusta are dealt with. During the first run—212 days operational period—pressure drop doubled in the first reactor. H_2S 0·018 vol % caused a corrosion rate of *ca* 0·018 inch/yr at 900° F for 1·25 and 5% Cr steels. Scale formation in the exchangers, piping, heaters, and reactors, in quantities < in the Ferndale unit proved troublesome. Lab and plant test data on a large variety of conventional steels, which agree well, and confirm the Ferndale results, show that temp and H_2S concn are basic variables in high-temp H_2S corrosion. From a consideration of these variables, metal losses and scaling of conventional structural materials can be predicted. Aluminizing affords some protection from scaling attack. As a result of field experience and lab and field corrosion tests, most Sovaformers include a pretreater, which desulphurizes the Sovaformer charge to <0·002 wt % S. Here again the scale formed with low Cr steels between 550° and 850° F for H_2S levels up to 0·03 vol % constitutes a problem. R. T.

ENGINES AND AUTOMOTIVE EQUIPMENT

1237. Combustion chamber deposits in high compression engines. M. W. Corzilius, D. R. Diggs, and R. A. Hoffman. *Petrol. Engr*, 1957, **29** (9), C40–2.—High compression engines in both lab and road conditions were studied. Surface ignition increased with C.R. and varied with the lubricant used. Slightly more combustion chamber deposits occurred with the use of a high-visc petroleum fraction lubricant. E. A. G. H.

1238. Investigation into the mechanism of oil loss past pistons. P. de K. Dykes. *Gas Oil Pwr*, 1957, **52**, 317.—A piston fitted with any desired arrangement of rings was motored in a cyl in such a way that it moved accurately along the axis of the cyl and the mean gas pressure in the cyl was maintained constant. The following results were obtained: (1) During a cycle large amounts of oil pass towards the combustion chamber, but most returns to the sump. (2) Rings in all

positions can be arranged to pass oil either upwards or downwards. If the lower rings pass oil upwards, results are always bad, even if the upper rings pass oil downwards. (3) Taper-faced or stepped rings are inherently " downpassing "; square-faced rings are symmetrical, but combined with a scraper ring are " downpassing." (4) Oil may be retained by the top land until " downpassing " rings on the top part of the piston return it to the sump. (5) Oil films on the cyl wall may be scattered if the top edges of the piston touch the wall. (6) Passage of oil and gas leakage are concomitant. (7) The shape of the ring and its relation to the ring groove affect oil loss.
H. C. E.

1239. Manifold injection in diesel engines. Anon. *Gas Oil Pwr*, 1957, **52**, 287.—Part of the fuel is introduced into the cyl as a fine mist, whilst the remainder is supplied by injector as usual. Tests on a single-cyl CFR engine with Ricardo comet-type chamber head and C.R. 17 : 1, using 44 C.N. fuel, showed that, with the supplementary fuel 15% of the total fuel, the smoke density fell from 60 to 12% and there was a decrease in fuel consumption of *ca* 10%. A lower rate of pressure increase provided smoother operation.

3 methods of introducing the supplementary fuel were used. One method, in which atomized fuel is carried by the air stream through a series of baffles designed to remove the coarser droplets, gave the greatest increase of b.m.e.p., but the gain in power was offset by the power demand of the device. Other methods were by spray nozzle and by vaporizer at 250° F.

It appears that combustion is improved by premixing. The increase in b.m.e.p. may be due to better air utilization, and to an increase in the thermal efficiency of the engine as a result of decreased ignition lag. H. C. E.

1240. Exhaust gas treatment. American investigations into methods of removing hydrocarbons. Anon. *Auto. Engr*, 1957, **47** (11), 446.—The most important operating variables are gas temp, exhaust flow rate, and exhaust gas composition. Variables that may be expected from the typical automobile under different driving conditions and their importance to the designer of an exhaust treating device are discussed. Oxidn devices, both cat convertors and after-burners, are considered.
D. K.

1241. Air pollution from road transport: the vehicle operator's viewpoint. A. T. Wilford. *Gas Oil Pwr*, 1957, **52**, 318–20.—The main causes of diesel smoke emission are over-injection of fuel and faulty maintenance (*cf* Abs. No. **1975**, 1957). The author considers that variations in the quality of the fuel may also have an effect on smoke emission, and that a more volatile fuel may have beneficial effects. The practice of treating the exhaust gases of automotive diesel engines to achieve complete combustion, *i.e.* by using an after-burner at 1700° F or by employing a cat, is not recommended. H. C. E.

SAFETY PRECAUTIONS

1242. Air agitation controls crude tank fires. J. L. Risinger. *Pipe Line Ind.*, 1957, **6** (5), 65.—Knowing the characteristics of the crude oil at a sp location is extremely important to control and extinguishment of fires. With high fl. pt. crude oil the air agitation method alone will extinguish the fire, if applied before the heat wave is of sufficient depth for the oil temp to be raised above its fl. pt. Air agitation alone cannot be depended upon to extinguish a low fl. pt. crude oil tank fire. With conventional fire-fighting techniques, air agitation cools down the burning surface, simplifies control, and reduces chances of slop-over. R. T.

1243. Stay alive around sour crude. A. Gibbon. *Pipe Line Ind.*, 1957, **6** (5), 58–9.—Sour crude can kill. A concn of 0·15% H_2S in air, inhaled for 2–15 minutes, may prove fatal. For protection the correct mask must be used. Injury is avoided by observing the simple rules presented. R. T.

1244. Guard against detonation hazards. E. L. Ghormley. *Petrol. Refin.*, 1958, **37** (1), 185–90.—Industrial piping systems handling flammable gases mixed with air or oxygen may be exposed to a detonating type of explosion. Every precaution should be taken in the plant design to preclude the possibility of detonation. The author outlines the combustion and flammability limits and detonation limits of several common gas–air and gas–oxygen mixtures. The various sources of ignition primarily responsible for detonation are outlined and methods of designing for protection considered. Limitations in the use of normal flame arrestors for detonation protection are pointed out and effective types of detonation barriers considered. J. R. T.

1245. Explosion-proof electrical systems. R. P. Northrup. *Petrol. Refin.*, 1958, **37** (1), 159–62.—Tidewater Oil Co's recently completed Delaware refinery embodies an excellent example of a well-engineered, well-constructed electrical system, largely explosion-proof. The construction called for considerable planning and ingenuity to determine the existence, degree, and extent of the refinery's hazardous areas. This article shows how various areas were classified and then equipped in order to minimize the hazard of explosive flammable substances being processed or stored throughout the refinery. J. R. T.

1246. Formation of static electricity by motion of liquids. (In German.) A. Klinkenberg. *Erdöl u. Kohle*, 1956, **9**, 779–82.—Flowing liq may carry an elec charge, which may produce a dangerous potential in an insulated container undergoing filling. If, however, all equipment items in contact with the flowing liq are grounded or electrically connected, danger of an explosion—due to the high insulating properties of many petroleum products—may still exist. Moist gasoline is a very good insulator. Prerequisites for the origin of accidents through static electricity, and sp operations which may be considered dangerous are discussed. Charges may originate at the interface between a hydrocarbon oil and another non-hydrocarbon foreign material under static conditions. Relative motion of these materials may separate opposite charges and—in an insulating liq—may generate high potentials. Precautionary measures against accidents through static electricity are presented in the order in which they intrude in the single steps of the procedure which leads to an explosion.
R. T.

1247. Protecting pipeline stations against electrical transients. Anon. *Oil Gas J.*, 13.1.58, **56** (2), 103.—Essentials for proper protection include station-type lightning arrestors at transmission voltage level for transformer supplying station, surge protection on station bus, and power supply system with either dead line check relaying or time delay automotive reclosure. G. A. C.

1248. Industrial safety must be planned carefully. H. E. Springer. *Elect. World*, 1957, **148** (25), 92–4.—Planning safety for the electrical system of a plant is essential. Provision of adequate spacing, guarding of moving parts, enclosure of current-carrying equipment, and earthing is necessary. Good ventilation for rooms containing switchgear and motor controls is essential. Use of tag-out cards is advisable. All personnel must be educated to the dangers involved.
P. J. K.

ECONOMICS AND MARKETING

1249. Refinery runs will be up 1·7% in 1958. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 170.—Tables show yield trends yearly from 1956 to date and runs by district in the U.S.A. from 1922 (in 5-year steps) to 1952, thence yearly to 1957. Tendency was for more gasoline and dist production. G. A. C.

1250. World production increases 3·7%. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 169.—Tables show production in countries outside the U.S.A. For third year running figures exceed U.S. domestic production. G. A. C.

1251. The fuel problem in this country. Sir John Hacking. *J. Inst. Fuel*, 1957, **30** (203), 681.—Presidential address to the Fuel Luncheon Club. Broad aspects of fuel usage are considered. D. K.

1252. Cost comparisons by capitalized cost. F. C. Jelen. *Petrol. Refin.*, 1958, **37** (1), 195–201.—Capitalized cost can be defined as the present value of all costs (and receipts) for an indefinite time. This article presents an exact method for making cost comparisons based on capitalized costs. Interest has been considered for all the mathematical relationships given. Several examples are given to illustrate the application of the method. J. R. T.

MISCELLANEOUS

1253. Whence came the hydrocarbons? T. A. Link. *Bull. Amer. Ass. Petrol. Geol.*, 1957, **41**, 1387–402.—The author points out the wide divergence of current opinions between astronomers and geologists on the origin of the hydrocarbons found in the earth's surface.

The detection of hydrocarbons in meteorites seems to suggest that they may have been derived from living organisms on a planetary body which has disrupted, and Hoyle has suggested that petroleum hydrocarbons have been squeezed out from the interior of the Earth. Such ideas are, of course, directly contrary to the commonly-held geological view of the sedimentary organic origin of petroleum. E. N. T.

1254. Applied hydrocarbon thermodynamics. Pt I. A review of fundamentals. W. C. Edmister. *Petrol. Refin.*, 1958, **37** (1), 173–8.—The first of a series of articles with the object of presenting thermodynamic tools for solving engineering problems, this discussion of fundamentals is restricted to simple but real systems. It includes definitions of heat and work, development of the first and second laws of thermodynamics, Maxwell relations, heat capacities, energy, enthalpy, entropy, and the Joule–Thomson coeff. Sufficient theory and mathematical derivations are included to show the basis for, and the preparation of, these tools. J. R. T.

1255. Models, a new maintenance tool. H. Kershaw and A. F. Hollowell. *Petrol. Refin.*, 1958, **37** (1), 132–5.—The use of scale models in plant design provides processing industry with a new tool for cutting plant maintenance costs. Application of models in maintenance planning during the original lay-out and design of a unit is outlined. The exceptional possibilities offered by scale models for planning maintenance after the unit is put on stream are discussed, and the benefits obtained from these models in both contract and emergency maintenance are also outlined. J. R. T.

1256. Planning electrical maintenance? A. J. Sullivan. *Petrol. Refin.*, 1958, **37** (1), 149–51.—Tidewater Oil Co's Avon refinery has achieved improved electrical maintenance by placing positive emphasis on a planning and scheduling concept. This article outlines the system employed and describes its application to refinery equipment. The system allows a realistic figure to be placed on preventive maintenance, which in turn may vary from the bare minimum to the most comprehensive programme. Another advantage of the system is the ease of application to large or small electrical systems in plants which have well-organized maintenance. J. R. T.

1257. How to prepare for chemical cleaning. I. Bielek. *Petrol. Refin.*, 1958, **37** (1), 155–8.—Many refineries utilize the experience and specialized equipment of chemical cleaning contractors rather than attempt the job themselves. Careful preparation before the contractor arrives ensures a better, safer cleaning job with less down-time for the refinery units involved. These preliminary preparations are discussed in some detail under 3 main headings, namely, co-operative planning between refinery and service company personnel, thorough discussion of equipment being cleaned and the materials handled by this equipment, and arrangements for proper piping for cleaning the equipment. J. R. T.

1258. Why prefab insulation cuts costs. W. C. Turner. *Petrol. Refin.*, 1958, **37** (1), 163–6.—Each thermal insulation has its own individual properties, which may be classified as thermal, chemical, and physical properties. In many cases a combination of insulation materials is required rather than a single one. Standardization of sizes was thus made necessary to make possible the use of combined materials. This article outlines the Dimensional Standard system and discusses the use of prefabricated insulation. Prefabrication of insulation provides a means to obtain more economical and more quickly installed insulation of better quality. In addition, for maintenance, it is possible to remove and replace fitting covers, thus effecting considerable savings. J. R. T.

1259. The case of the scaled-up reforming unit. J. D. Hudson. *Petrol. Refin.*, 1958, **37** (1), 170–2.—Methods of chemical cleaning of a platinum cat reforming unit used by an Ohio refinery are outlined. Components cleaned include the absorber and depropanizer towers, the furnace, and heat exchangers. The towers were cleaned by using a solvent–acidic detergent, and the furnace and exchangers by using a combination of inhibited acidic detergents. This chemical cleaning resulted in large savings and fewer maintenance problems. J. R. T.

1260. Rugosity in practice. R. Poinsard. *Rev. Inst. franç. Pétrole*, 1957, **12**, 1294–6.—Importance of surface finish in aircraft construction is stressed. Precise degrees of surface finish and methods to be used should be specified on drawings. W. A. M.

1261. Gleanings of the Third Congress of Engineers and Technicians. Anon. *Nafta (Krakow)*, 1957, **13**, 209–30.—Whilst the detailed description of the proceedings of the congress appeared in a previous issue of *Nafta (Krakow)*, it is worthwhile to recall that amongst the engineers present were delegations from the U.S.S.R., Czechoslovakia, Jugoslavia, Rumania, Hungary, and Bulgaria. Conclusions of interest to the petroleum industry are summarized. M. S.

1262. New look in human relations. E. L. K. Frost. *Pipe Line Ind.*, 1957, **6** (5), 54–6.—Due to rapid growth and fast-changing operational methods, the pipeline industry is placing increasing emphasis on training, employee communications, recruitment, and management development. An expert's views are presented on applying direct research to find a

common factor in comparable situations and background research to get the facts. R. T.

1263. Certain data about the development of the petroleum industry in the U.S.S.R. Anon. *Nafta (Krakow)*, 1957, **13**, 233–4.—This brief summary includes figures of petroleum production from 1913 to 1956 for the U.S.S.R. and for the separate republics. Whilst since 1945 (19·4 million tons/year) the increment has been of the order 12–15% up to and including 1953, it has for the following years been 18 and 20%, reaching eventually 84% rise/year. In those years the feature of Soviet oil industry has also been the emergence of the Russian Republic, with 49¼ million tons in 1955 (70% total), as the biggest producer of crude in the U.S.S.R., ahead of Azerbedjan Republic (where Baku lies) with 15·3 million tons (20%), which reverses the pre-war position. A long-distance pipeline from W. Ural to Omsk and eventually to Novosibirsk is being built. Gas reserves are estimated at 10^{12} cu. m., and production reaches 6×10^9 cu. m. Gas serves several cities as source of power by means of numerous pipelines. M. S.

1264. Hungarian refining industry. K. Kachlik. *Nafta (Krakow)*, 1957, **13**, 230–2.—The author has known the Hungarian oil industry since 1939, when he was offered the position of refining project manager for the then newly discovered crude. There were then 2 old-fashioned refineries in Hungary, and now, notwithstanding the ravages of war, the Hungarian production of crude is of the order of 1·5 million tons p.a., whilst refining capacity reaches 2·25 million tons p.a. The industry is dependent on the Ministry of Chemical Industry and Power in Budapest, and is divided into refining and production sections. The latter includes drilling and exploration and has a drilling lab, while the former covers refining, transportation, and Inst. of Oil Technology (Veszprem and Budapest). Distribution is in the hands of the Ministry of Commerce, and associated with the oil industry are Inst. of Geophysics, Mining, High Pressure Application, the Petrochemistry Division of the Ministry for Chemical Industry, and the Planning Office. Due to high authority of those dealing with the industry, it has developed rapidly. The director of the Inst. of Oil Technology is Prof. Dr Freund, and the Inst. employs 150 people on the refining side and 100 on the production side. They concentrate on dist and cracking on pilot scale and, in the petroleum chemical field, on utilization of cracking gases. Some of the problems tackled are reforming of Hungarian crude (high sulphur content) and methane to acetylene process (together with Rumania). Automotive research is carried out in Hungary on 5 engines: 2 CFR, and 3 Soviet ones. Although of the 4 refineries in production after the war 2 were old and only one was producing lubricants, the Hungarians have renewed a great deal of the equipment and built a new refinery as well. Hungarian crudes include highly naphthenic and highly paraffinic materials. Each is refined according to the problems it presents. Some Austrian crudes are also refined into fuels for " glowing bulb " (diesel?) engines. This and many other heavy fuels are produced with as much as 1% of S and used with an inhibitor. Acid treatment is accomplished with the use of centrifuges, solid lubricants are made near Budapest, and there are 2 equipment factories, although many items are made in general works. M. S.

1265. Instruments for measuring small quantities of sulphur dioxide in the atmosphere. W. G. Cummings and M. W. Redfearn. *J. Inst. Fuel*, 1957, **30** (202), 628.—An automatic recorder and a portable meter have been developed. Both instruments are sensitive to 1 part of SO_2 in 100 million parts of air over the range 0–50 p.p.h.m. The range can be extended. The recorder is intended for a long period of continuous operation on a fixed site. Investigations with this apparatus show that when plumes from modern power stations reach the ground the conc of SO_2 is then low. 5 refs and photographs of the instruments are included. D. K.

1266. Forecast—still higher octane. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 172.—Trend in 1958 will be towards higher reforming and lower yields with increase in alkylation for motor fuels. G. A. C.

1267. Certain aspects of the deposition of dust. D. H. Lucas. *J. Inst. Fuel*, 1957, **30** (202), 623.—The theory and practice of the measurement of deposition is considered. Some tests show that a deposit gauge at ground level collects a greater quantity of dust than one 4 ft above the ground. It is concluded that much of the additional dust is re-entrained from the ground. Experiments have shown that a standard gauge catches, on average, twice as much dust when its bowl is wet as it does normally. The dust collected in the rural district around Little Barford Power Station was examined microscopically, and it was established that only ¼ originated at the power station. D. K.

1268. Your design reference file. IX. R. Cushing. *Chem. Engng*, 1957, **64** (12), 275–80.—Useful refs on instrumentation refrigeration, illumination, and structural engineering are presented with abstracts of each. 131 refs. P. J. O.

1269. United Kingdom petroleum legislation in 1957. V. Biske. *Petrol. Times*, 31.1.58, **72** (1578), 94.—Oil in navigable waters, taxation of petroleum, Customs regulations, control of petroleum, safety precautions, judicial decisions, and other legal matters concerning the year 1957 are reviewed. G. A. C.

1270. American Chemical Society papers. Anon. *Petrol. Times*, 17.1.58, **72** (1577), 59.—Abstracts are given of some 26 of the papers presented at New York, Sept. 1957, and include structure of hydrocarbons, hydrocracking, thermal alkylation and radiolyses of ethane, isotopic and scavenger studies. G. A. C.

1271. New cost-control methods. J. W. Davies and P. P. Entrikin. *Oil Gas J.*, 20.1.58, **56** (3), 140.—The use by Esso Standard is described of an IBM 705 computer to carry out cost-control operations at Baton Rouge refinery. G. A. C.

1272. Electronic computers in engineering and research. W. Downer. *Petrol. Engr*, 1957, **29** (10), C20–2.—Applications of electronic computers in the petroleum industry are outlined. E. A. G. H.

1273. A new super glass. D. M. Taylor. *Petrol. Engr*, 1957, **29** (9), B78–81.—A very hard type of glass, of lower density than aluminium and with a high rupture strength, has been developed. The glass loses little mechanical strength up to 1300° F, and its coeff of expansion may be varied by the manufacturing process. Applications of the glass in the oil industry are possible in pressure vessels and piping subject to corrosion and many other cases. E. A. G. H.

1274. Brazil's petroleum industry. F. C. Williams and A. S. Moggi. *Petrol. Engr*, 1957, **29** (7), C53–4.—The nationalized petroleum industry of Brazil is described. Although large sedimentary basins are present, there is only one producing area with an output reaching 21,000 b.d. in 1956. Most of the oil refined is imported, and total refinery capacity was 125,000 b.d. in 1957. E. A. G. H.

1275. Predicting V–L equilibrium data. Pt 2. L. N. Canjar *et al.* *Petrol. Refin.*, 1957, **36** (10), 135–9.—A correlation is presented which enables vapour–liq process calculations to be carried out without the use of plots, graphs, or charts. The method utilizes equations developed in an earlier article (*Petrol. Refin.*, 1957, **36** (9), 291) to reduce a graphical multicomponent mixture correlation to analytical form. Since the soln is entirely analytical, it can easily be adapted to electronic computer programmes. J. R. T.

BOOK REVIEWS

Industrial Chemicals. By W. L. Faith, Donald B. Keyes, and Ronald L. Clark. New York: John Wiley and Sons Inc., London: Chapman and Hall Ltd, 1957. Pp. ix + 844. 128*s*.

This is a second edition of a volume which was first published in 1950. It has now been revised and enlarged to incorporate the great changes that the chemical industry has undergone during these seven years.

The original edition comprised 652 pages and cost 84*s*. The present edition comprises 844 pages and costs 128*s*. The authors have added 35 chemicals to their original 106 and have dropped only one. Each chemical is treated individually from the U.S. standpoint in a separate chapter, which covers the manufacture, use, quantity produced and price range over the last 20 years, chemical and physical properties, the usual grades and how it is packaged, who makes it and where, as well as comments on economic trends.

The treatment is at times a little superficial, but this is only to be expected when dealing with 140 chemicals in 844 pages. Thus, on the inorganic side the contact and chamber processes for sulphuric acid are briefly described and reference is made to the production from H_2S. The statistics given show that this source is becoming of increasing importance, but no indication is given of the necessity for, and the means of, removing water formed by the combustion of the hydrogen in the H_2S if concentrated acid is required. It is stressed that regenerated acid will become more important in the future, but sludge acid from oil refineries is merely referred to as a source of sulphuric acid with no description of how this source is converted to clean acid.

Similarly, hydrogen production covers a number of different processes but omits the partial oxidation of hydrocarbons with oxygen.

It must be emphasized that this is a book written for readers in the U.S.A., and hence all statistics, which are well up to date, relate to the U.S.A. It can sometimes be misleading to the uninitiated, *e.g.* "one ton" is never defined, so that it is necessary to know that one ton of sulphuric acid is a long ton, whereas when referring to organic chemicals, such as acetic anhydride, one ton means a short ton.

Again, the emphasis on the U.S.A. is unfortunate for readers of the book in the U.K., since methods of manufacture not used in the U.S.A. are not included, *e.g.* a chapter is given on Oxo alcohols, but no reference is made to the production of Alphanol from straight-chain alpha olefins. Similarly, a chapter is given on ethyl chloride, where the main synthesis route of the addition of HCl to ethylene is described and passing reference is made to the fact that it is possible to make it by the chlorination of ethane, but no mention is made of the integrated Shell process, which is used in Britain by Associated Ethyl Company, where ethane is chlorinated in the presence of ethylene and the HCl formed from this chlorination then adds on to the ethylene in the mixture to form more ethyl chloride. Again, there is no mention of the direct hydration process for converting propylene to *iso*propyl alcohol as practised by I.C.I.

On the other hand, the book is packed with a wealth of useful information. Although there are 140 chapters, one for each chemical, many more chemicals are referred to, and these references can easily be found from the excellent index. Thus, hexamethylene diamine for nylon is referred to under adipic acid and terephthalic acid under xylenes.

The book is remarkably up to date, except for an occasional lapse, as for example under "ethyl alcohol," where reference is made to the fact that "The modified Fischer–Tropsch plant at Brownsville, Texas, will be a competitive factor not to be overlooked." It was announced in Sept. 1957 that the plant had been shut down and it is unlikely to operate again.

The book is well printed and nicely bound, as it should be for its price. It is relatively free from misprints, although on p. 807 a new compound "boron difluoride" seems to have been discovered and on p. 618 "Ziegler" is spelt "Zeigler."

This is an excellent book for use as a first reference on any of the more usual industrial chemicals, whether it be to obtain an idea of its method of manufacture, the containers which can be used for its transport, or its main end uses, and as such it will certainly be used by the reviewer. Further details must thereafter be sought in more specialized reference books.

M. A. M.

Plant Design and Economics for Chemical Engineers. Max S. Peters. New York, London: McGraw-Hill Book Co., 1958. Pp. ix + 497. 85*s*. 6*d*.

This is what every chemical engineer must know, and it is put before him in a way that excites his interest and sympathy. The title of the book is an excellent description of its contents. Economics has often been pleaded against the designer as an external authority to curb his enthusiasms and put a ceiling on his flights of fancy, or brought in at the last stage to frustrate his purposes. Here it takes a proper place. The chemical engineer must consider all the properties of his materials that affect the design; for a kilogram of gas this may include the pressure, temperature, entropy, co-ordinates of position and of velocity—and the cost. All are equally physical properties, all equally amenable to computation; processes may become prohibitive because of cost just as they may be prohibitive because of the pressure or temperature; and there is an optimum cost, an optimum pressure, and optimum value of all these constants derivable from a study of the process.

This is good, but the author does better than this. He honours his guest. The first eight chapters, over a quarter of the book, explain without jargon the monetary side of business, how costs arise, how they are assessed, and how they are met. The distinction between financial and economic factors is well made, so that the chemical engineer will at least understand that a process which promises a quick return on capital may still be inadvisable if it requires money to flow faster than it can be obtained. All necessary aspects of the matter are shown and the chemical engineer is not bothered with what he need not know. The remaining chapters apply this knowledge to design in the fullest sense, dealing in detail with handling of materials, heat transfer, mass transfer, and filtration.

The book is well written, and is throughout a plea by precept and example for clear thinking. The slang of the engineer and of the accountant are equally despised and unused. The chapters give a number of problems for solution placed before the reader in the way he would in practice meet them.

The book is produced in America and uses laws and customs of the U.S.A. as instances, but this does not detract from its value to a worker in another country. Laws and taxes change, and no book can keep up with them; clearly the chemical engineer will use the latest relevant figures just as he would of any physical constant in his problem. It is sincerely recommended to the chemical engineer who begins a career in industry; and it may cure the frustrations of some that have proceeded some way in such a career.

D. P. P.

Gulbenkian: an Interpretation of Calouste Sarkis Gulbenkian. John Lodwick. London: Heinemann, 1958. Pp. 289. 21*s*.

Mr John Lodwick is a novelist with a dozen works to his credit; these may, for all the present reviewer knows, be excellent, and there is no intrinsic reason why a novelist should not make a successful biographer, with a chance to use his gifts of observation, sympathy, and reconstruction. But, sad to say, the book now before us does little to support this thesis. It was disappointing enough that the first biography of the late C. S. Gulbenkian (that of Ralph Hewins) was a disappointing, unworthy book; it makes it worse that the second attempt, that of Mr Lodwick, should be no sort of improvement, and the deceased financier-colossus still awaits an adequate biographer.

Lodwick's fundamental weakness is his complete failure to familiarize himself with the background of his subject—the more necessary since Gulbenkian operated in fact in a fairly restricted field of activity, a close knowledge of which is indispensable to an understanding of his difficulties, his achievement, and his personality. Lodwick, on the contrary, knows evidently almost nothing about petroleum or its industry, and, one would say, remarkably little about the Middle East, and perhaps not very much about high finance or City economics; nor did he, to compensate for all this, ever know personally the subject of his book. This could have been made good by a careful collection of second-hand material from Gulbenkian's friends and collaborators; but there is little sign that Mr Lodwick took much trouble over this. He relies heavily upon his collaboration with D. H. Young, who was C. S. G.'s secretary (or one of his secretaries) for many years. Mr Young had, of course, remarkable opportunities of observing Gulbenkian at the closest quarters during the main constructive part of his career, and he has, in fact, a fund of personal reminiscences to draw upon. But it is doubtful whether he was at any time a competent or constructive judge of the petroleum industry, or that he enjoyed more than a limited amount of Gulbenkian's confidence. It results from this that the Young reminiscences are largely trivial and heavily coloured by his own antipathies and frustrations, and form an inadequate basis for a biography of C. S. G. However, Mr Lodwick has very little else to go on and took, it would seem, little trouble to augment it; a great deal of material is available, but there is no sign that it was used. The pages are eked out with a quantity of semi-facetious history, the record of events is often misleading or trivial, and defaced by a number of mis-statements, by presumably invented conversations, by superficial and therefore valueless accounts of other characters (Cowdray, D'Arcy, Lane), and by sketches of the character of Gulbenkian himself so unfavourable as to make him, contrary to the judgment of practically everybody who knew him well, a quite intolerably unattractive character. There is plenty of room, both in the oil industry and among a wide public outside it, for a reasonable, readable account of an undoubtedly great financier and oil diplomat, who, whatever his personal shortcomings, played a major part in the development of the industry—and belonged to a type which, since it is now extinct, is all the more deserving of sympathetic study. But in all this Mr Lodwick has helped us very little, and if he ventures again into biography we would respectfully advise him to take a very great deal more trouble.

S. H. L.

The Physics of Flow through Porous Media. A. E. Scheidegger. Toronto: University Press; London: Oxford University Press, 1957. Pp. xii + 236. 110*s*.

In the main, this monograph is built round an exhaustive bibliography and should be of very considerable value to all research workers in the field indicated by the title. The scope of the work is, of course, not limited to petroleum problems, but covers also such matters as filtration and drainage.

The greater part of the text is concerned with the fundamental properties of fluids, the structure of porous media, and the concept of permeability. In this connexion there are extensive discussions of the theoretical derivation of Darcy's Law and of the various attempts which have been made to correlate permeability with porous structure, including, for example, a critical evaluation of the Kozeny theory and a presentation of statistical flow theories. There are also theoretical sections on adsorption, capillarity, the flow of miscible fluids, turbulence, and molecular effects.

For the rest, the basic differential equations of flow are derived and there is a brief review of the various types of solution available for steady and transient, single-phase and multi-phase flow. In a book of this size it would clearly not be possible to discuss in detail either specific mathematical solutions or experimental results, but a few illustrative samples are given, together with many references to the literature. These specific examples are of course readily available in the standard text-books, as are also various details of experimental techniques which are given in this monograph. Possibly some of the space devoted to these features could have been more usefully employed by expanding the general discussion and giving a more detailed guide to the many engineering references which are included in the bibliography.

However, the selection of subjects for detailed treatment has admittedly been somewhat arbitrary. What is of particular interest is that there does not appear to be any other single book giving a comparable discussion of the fundamental theoretical aspects of the phenomena, and it is from this point of view in particular that this monograph should be most valuable.

C. J. M.

Review of Benzole Technology 1956. The National Benzole and Allied Products Association. London: The Association, 1957. Pp. 417. £1 1*s*. (Postage 1*s*. 6*d*.).

Fourth in the series of annual reports published by the NBA, this volume summarizes the information published during 1956 on the subject of benzole.

The whole industry is covered from the production of the raw material to the utilization of the refined products in various fields. In the latter connexion it is of interest to note that it has been estimated that American requirements of aromatic hydrocarbons will rise from 470 million imperial gallons in 1955 to 1161 million in 1975. Of these quantities 244 and 906 million respectively are from petroleum.

Final chapters of this book cover safety and handling and economics and statistics. In 1956 there was a marked increase in crude benzole production in the U.K., the total being 120·3 million gallons in comparison with 110·6 in 1955.

In preparing this valuable and useful survey of the benzole industry over one thousand literature references have been consulted, and details of these are given.

ADDITIONS TO THE LIBRARY

Entries are in subject order arranged according to the Uren "Classification for Petroleum Bibliography," the number preceding each entry indicating the classification and corresponding to that used in the "Library Catalogue" published by the Institute. Books marked with an asterisk cannot be borrowed from the Library.

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*020 World Petroleum Congress. Fourth World Petroleum Congress, Rome, June 6–15 1955, proceedings. Section 2. Drilling, production. Rome, Carlo Colombo (1956). 640 p.

050 Herbert, J. *ed.* Glossaria interpretum: Conference terminology: a manual for conference members and interpreters in English, Russian, French, Spanish, German. Amsterdam, Elsevier, 1957. 147 p. Published by École d'Interprètes de l'Université de Genève; Auslands- und Dolmetscherinstitut der Johannes Gutenberg-Universitat, Mainz in Germersheim; Institute of Language and Linguistic School of Foreign Service, Georgetown University, Washington, D.C.

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080 Gas Times. Who's who in the gas industry, 1958. London, Arrow Press, 1958. 238 p.

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080 Standard Oil Company (New Jersey). Annual reports 1945 to 1956. New York, Standard Oil, (1957).

090 British Standards Institution. Carbon and hydrogen combustion train (Pregl type) microchemical apparatus. Group A: combustion trains for the determination of elements. London, BSI, 1958. 19 p. (BS 1428, Part A1 : 1958.)

090 British Standards Institution. Carbon tetrachloride. London, BSI, 1957. 10 p. (BS 575: 1957.)

090 British Standards Institution. Di-*n*-butyl phthalate. London, BSI, 1957. 9 p. (BS 573 : 1957.)

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090 British Standards Institution. Formaldehyde solution. London, BSI, 1957. 11 p. (BS 2942: 1957.)

090 British Standards Institution. Glossary of terms relating to powders. London, BSI, 1958. 16 p. (BS 2955 : 1958.)

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*130 Organisation for European Economic Co-operation. The search for and exploitation of crude oil and natural gas in the OEEC area. Paris, OEEC, 1957. 79 p. Supplementary plans include: geological map of Europe, tracings showing concession areas, table showing the geological distribution of oil and gas horizons.

140 Commonwealth-American Current Affairs Unit. Oil and the Middle East. London, Current Affairs Unit (1957). 23 p.

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OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

1276. Structure, development, and nomenclature of the lock of Jurassic Ostracods after Sylvester-Bradley. (In German.) B. Moos. *Erdöl u. Kohle*, 1956, **9**, 832–4.—Proceeding from collections from fuller's earth, a basic study of the Early Mesozoic development of the Ostracod lock, sp of the genus *Cythereis* is presented. 6 lock variations are presented schematically, renamed, and exactly defined. A detailed description of the shell characteristics and development and habitat follows. R. T.

1277. Completion picture brightens a little. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 148.—Total number of well completions in the U.S.A. in 1957 was 7·4% lower than in 1956, but higher in the second than in the first half of the year. In 1957 there were 27,476 oil wells, 3912 gas wells, and 22,887 dry holes drilled. Completions and footage are tabulated by states. J. C. M. T.

1278. Frio offers lucrative hunting. A. M. Tolbert. *Oil Gas J.*, 6.1.58, **56** (1), 156.—The Frio formation occurs in the subsurface of W. Texas Gulf Coast region, and consists of a wedge of Oligocene clays and sands dipping and thickening seawards (SE.). In the same direction the deposits change character from non-marine to marine. The greatest sand development occurs along the transition or shoreline area, and this NE.–SW. zone generally coincides with the main productive trend. Salt domes are important; trapping conditions are also provided by a line of depositional faults. There are *ca* 215 Frio fields in the upper Gulf Coast of Texas, of which 27 have already produced over 25 million brl of oil. J. C. M. T.

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1279. Salt domes make headlines in 1957. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 224.—The first commercial production on any of the 17 known domes of the inland N. Louisiana salt basin was obtained during 1957 from the Lower Cretaceous Palusky sand at 7460–7466 ft on the Minden salt dome. The large Pescadito feature in Webb County, Texas, was proved during the year to be a salt dome, thus extending the known limits of the SW. Texas salt basin 50 miles W. Alabama's third salt dome was discovered *ca* 20 miles NW. of McIntosh Dome, S. Washington County. J. C. M. T.

1280. Exploration steps up in Arkansas Valley. N. S. Morrisey. *Oil Gas J.*, 20.1.58, **56** (3), 194.—Operators are re-evaluating the long-ignored Arkansas Valley, between the Boston and Ouachita Mountains, N. Arkansas. The valley is an E.–W. trough with *ca* 30,000 ft of Palæozoic sandstones and shales. Surface rocks belong to the Carboniferous system, and topography is related to structure. Air photography and surface geological mapping are the principal exploration methods. Structure involves close folding and overthrusts on S. side of basin adjacent to the Ouachita belt, becoming gentler and with normal faults replacing thrusts N. No commercial oil has yet been found, but there are over 30 gas pools, mainly in sandstone lenses in the Atoka formation. Pre-Pennsylvanian possibilities have yet to be evaluated, but possible reservoir rocks occur in the underlying Mississippian and Ordovician, including the St Peter sandstone in the latter. J. C. M. T.

1281. Wildcat gets show. Anon. *Oil Gas J.*, 20.1.58, **56** (3), 93.—Big Horn Powder River Corpn and Hathaway Co. recovered 1540 ft of clean oil in D.S.T. of the Lower Paradox–Pennsylvanian at 5457–5467 ft in wildcat 1 Government, in Montezuma County, Colorado. Significance of this show is that it is the first indication of commercial oil in this E. part of the Paradox basin. J. C. M. T.

1282. The Oklahoma story: deeper pays and multiple pays. F. J. Gardner. *Oil Gas J.*, 13.1.58, **56** (2), 143.—Despite 50 years' exploration and production, 1957 was one of Oklahoma's best discovery years, and it is believed that many pools remain to be discovered, especially by deeper drilling. Chief target at present is the Ordovician Simpson group of formations. Latest new field discovery well is Gulf 1 Beard in SW. McClain County, with production on test of 66 brl/hr of 39° API oil from the first Bromide sand at 10,739–10,814 ft, 40 brl/hr plus heavy gas flow from the second Bromide sand at 10,854–10,944 ft, and 56 brl/hr of 38° oil in the Tulip Creek formation at 11,000–11,164 ft. This well is at present drilling ahead at 12,000 ft. The structure is a buried fault block. J. C. M. T.

1283. South-Central Nebraska stirs. Anon. *Oil Gas J.*, 3.2.58, **56** (5), 157.—A third pool in S.-Central Nebraska basin was discovered by 1 Bottin, 3 miles N. of Alma. The wildcat was completed pumping 35 b.d. from Pennsylvanian Kansas City formation between 3396 and 3565 ft. J. C. M. T.

1284. Paradox basin still a headliner. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 206.—9 new oilfields were opened in the San Juan County, Utah, portion of the Paradox basin, and 15 in the San Juan basin in 1957, mostly producing from the Cretaceous Gallup sandstone. The first Mississippian production in Utah was obtained at Big Flat, near the N. rim of the Paradox basin. It is predicted that success will spread to the Colorado portion of the Paradox basin, and that further oil finds will be made around the rim of the San Juan gas basin. J. C. M. T.

1285. Mountain View field can pay. W. T. Smith. *Oil Gas J.*, 10.2.58, **56** (6), 178.—The Stenderup pool, at the S. end of the Mountain View field, nr Bakersfield, California, is a structure closed on the SE. by a fault and on the N. by sand pinchout. Reservoir is a pebbly sand equivalent to the Upper Miocene Stevens sand of the central San Joaquin Valley, producing at depths of 9659–9982 ft, with an average of 100 ft of pay. Aerial extent is *ca* 150 acres, and estimated reserves are over one million brl. The discovery well was completed to produce 900 b.d. of 27·5° API crude through a $\frac{32}{64}$-inch choke. J. C. M. T.

1286. Sespe scores twice. Anon. *Oil Gas J.*, 3.2.58, **56** (5), 152.—Wildcat 1 H.O. Borchard on the Oxnard plains of Ventura County, California, flowed 759 brl in first 24 hr through a $\frac{18}{64}$-inch choke from Oligocene Sespe sand at 10,810–11,267 ft. The field has been named the El Rio field. J. C. M. T.

1287. Washington—number 32. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 229.—Washington became the 32nd oil-producing state in the U.S.A. in 1957, when Sunshine Mining Co. *et al*, 1 Medina, Ocean City, flowed 223 b.d. on test from Nye–Lower Miocene at 3940–3963 ft. Structure is a faulted anticline $3\frac{1}{2}$ miles long on the Pacific coast. J. C. M. T.

1288. Williston comeback. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 208.—Most important Williston discovery of 1957 was Silurian, Devonian, and Ordovician oil at Outlook in Sheridan County, NE. Montana. The discovery well, 1 Tange, of Amerada Petroleum Corpn was brought in at 2742 b.d. early in the year, and other producers followed. In neighbouring N. Dakota Mississippian oil was discovered in the Burke County lignite area near the border with Saskatchewan. J. C. M. T.

1289. Gas discoveries spark news north of border. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 230.—Most important Canadian wildcat discoveries in 1957 were oil in the Slave Point middle Devonian at Virginia Hills; gas in the Rundle Mississippian in the Waterton Park–Castle River area; and oil in Devonian reefs N. of Calgary at Innisfail—all in Alberta. J. C. M. T.

1290. Pan American quits Jamaica. Anon. *Oil Gas J.*, 13.1.58, **56** (2), 69.—Since 1956 Pan American Petroleum Corpn has drilled 3 unsuccessful exploratory wells in Jamaica to depths of between 5500 and 9200 ft and has now given up its prospecting licences there in preference for Cuba. An offshore test 19 miles off S. Central Cuba coast is now drilling at 1060 ft, and is scheduled to test the Cretaceous at *ca* 9000 ft on a seismic anticline. J. C. M. T.

1291. Guatemalan oil search starts. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 141.—Guatemala's first wildcat, 1 Carlos Castillo Armas, was recently spudded by Coastal Plain Oil Co. Location is *ca* 27 miles inland from Puerto Barrios on the Caribbean coast. Projected depth is 5500 ft. J. C. M. T.

1292. Sun group hits again. Anon. *Oil Gas J.*, 13.1.58, **56** (2), 70.—Sun–Atlantic–Seaboard Group completed its second major well in centre of Lake Maracaibo. The well, S.V.S.-4, tested 6063 b.d. of 31·6° API crude through a $\frac{3}{4}$-inch choke from a 98-ft section of basal Eocene at 9484–9582 ft. J. C. M. T.

1293. Maracaibo test hits. Anon. *Oil Gas J.*, 6.1.58, **56** (1), 88.—1413 ft of oil-sand is reported by Superior Oil Co. in Lama 2, on a concession in the middle of Lake Maracaibo. Total depth is 10,135 ft. On the same concession Nos 1 and 5 tested nearly 11,000 b.d. and No 6, 7000 b.d. J. C. M. T.

1294. Tectonics of the petroleum region surrounding the Persian Gulf. (In German.) A. Heim. *Erdöl u. Kohle*, 1956, **9**, 829–32.—Oilfield positions of the region around the Persian Gulf as far as Central Persia are mapped. In this territory immeasurable quantities of petroleum reserves—apart from

new discoveries—exist, of which only a small fraction is worked. Producing formations are preponderatingly Middle Tertiary to Middle Cretaceous limestones in the Zagros Mountain region and in Central Persia, and Mesozoic sandstones on the Arabian side of the Gulf. All productive zones are on anticlinal structures. Facies illustrations with explanatory legend are presented. R. T.

1295. The oil geology of Africa. J. C. M. Taylor. *Petroleum, Lond.*, 1957, **20** (11), 417–21.—A vast platform of indurated Pre-Cambrian rock stretching over most of Africa has remained above sea-level since Archæan times. However, the sea made great inroads in the N., and extensive deposits of sedimentary rocks were laid down. Marginal sedimentary deposits occur on the E., W., and S. coasts. Exploration in these areas has led to the discovery of quantities of oil or gas in Nigeria, Gabon, and Angola. Large reserves of oil have been found in the Sahara and fresh deposits located in Egypt, Morocco, N. Algeria, and Tunisia. Extensive exploration is being carried out in the Belgian Congo, the Cameroons, Ghana, Libya, Madagascar, Mozambique, Senegal, Somalia, and Zanzibar. A. E. R.

1296. African search pushed. Anon. *Oil Gas J.*, 6.1.58, **56** (1), 86.—3 active drilling programmes are in progress in the deep sedimentary basin of E. Ethiopia, Somalia, and British Somaliland, and 2 more are planned for 1958. So far 7 tests, 5 of them drilled to more than 10,000 ft, have been abandoned as dry holes. J. C. M. T.

1297. Esso has Libya show. Anon. *Oil Gas J.*, 6.1.58, **56** (1), 88.—Encouraging shows of oil were encountered in a 40-ft section of the Devonian at 2100 ft in Atshan 2, drilled by Esso Standard (Libya) Inc., 75 miles SE. of the Edjele field across the border in Algeria. The well is being deepened. Atshan 1 on the same structure found gas. J. C. M. T.

1298. French hit again in Sahara. Anon. *Oil Gas J.*, 10.2.58, **56** (6), 86.—A third Saharan field is reported, 40 miles NW. of Edjele. Discovery was made by deepening Zarzaitine No 2 to *ca* 4000 ft. Production on test was 65 brl/hr. J. C. M. T.

1299. Study of conodonts from the Devonian and Carboniferous of the Adrar–Tanezrouft region (Sahara). M. Lys and B. Serre. *Rev. Inst. franç. Pétrole*, 1957, **12** (10), 1035–66.—Samples of Upper and Lower Visean and Upper and Middle Devonian age were studied. The source and lithology of the samples are given, together with an indication of the forms present in each sample. 24 genera and 45 species were recorded. The various forms are described and figured.

The Upper Devonian (Frasnian) was found to possess a group of forms which permitted its ready separation from the overlying Carboniferous, and from the underlying Devonian. Conodonts occur in the Visean, but individuals are few and belong to a small number of species. A table shows the age, distribution, and relative abundance of the various forms. G. D. H.

1300. Papua wildcat hits. Anon. *Oil Gas J.*, 10.2.58, **56** (6), 84.—Australasian Petroleum and Island Exploration Co. have found medium gas flows in a wildcat in same area as Kuru 1, which blew out 2 years ago. New well is Barikewa 3; total depth 8025 ft. J. C. M. T.

1301. Micropalæontological studies of the Palæozoic of the Montagne Noire. M. Lys, B. Serre, and G. Deroo. *Rev. Inst. franç. Pétrole*, 1957, **12** (7–8), 783–833.—Samples have been collected from rocks of Cambrian to Upper Visean age in the Montagne Noire. The rocks comprised shales, sandstones, micaceous silts, limestones, marls, calcareous shales. Thin sections and also segregated fossils were used in the studies, according to the rock type. Conodonts found in the Upper Devonian are described in detail, and their distribution and abundance are shown in a table. A further table shows the distribution of micro-organisms generally in the Palæozoic of Montagne Noire.

Photographs of parts of thin sections and of various conodonts are given. G. D. H.

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

1302. A new seismic dip plotting machine. J. A. Westphal. *World Oil*, 1957, **145** (6), 83.—A plotting machine has recently been developed which computes and plots the position of a reflection from a seismogram on to a cross-section. Hand calc or tabulations are not required, and it functions on the assumption of a linear increase of velocity with depth. The computation is made by a servo computer; this finds the migrated depth point by plotting in polar co-ordinates. A block diagram showing the procedure followed by the computer is given.

The machine is speedy in operation, it enables records to be tested to determine their validity, and a better interpretation than by hand is usually possible. C. A. F.

1303. Visual records made from magnetically recorded data. C. F. Hadley and J. D. Eisler. *World Oil*, 1957, **145** (6), 85.—A new process for converting magnetically-recorded seismic data to visual records is described. Multi-trace seismic records are obtained using electrically sensitive paper, and the record is immediately available without further processing. The method is as follows: a disk carrying wire brushes around its edge is rotated with its axis perpendicular to the direction of movement of the sensitive paper. Short pulses are fed to the brushes, which produce a number of traces on the paper by means of closely spaced dots whose position is determined by the time of occurrence of the pulses, which in turn is a function of the amplitude of the seismic signal. Time lines are also fed on to the paper, and a number of traces can be recorded.

The equipment is known as the Electrograph, and the latest design can produce 14 traces. Diagrams and photographs show the method of operation and the equipment. C. A. F.

1304. Advantages of magnetic band records for seismic measurements. (In German.) P. Velterlein. *Erdöl u. Kohle*, 1956, **9**, 754–7.—The special technique of magnetic recording systems—presenting greater flexibility in seismic procedure—is discussed. Recording on magnetic tape gives a permanent record of complex information readily stored and replayable at will. A visible cross-section of the area under observation is shown on a single record. The relative amounts of reflected energy are shown by the depth of tinting. In magnetic recording amplitude modulation is less satisfactory than frequency or impulse modulation. Interesting procedures permit visual observation of the seismogram before the actual reproduction. In field apparatus a phosphorescent screen may replace photographic paper for magnetic strip observation. New improvements suggested in magnetic tape technique are electronic technique perfection and automatic operation. R. T.

DRILLING

1305. Percussion-rotary combinations feature recent drilling research. Anon. *World Petrol.*, 1957, **28** (9), 38.—Increases in drilling costs have stimulated the search for cheap drilling methods, and 2 trends are apparent: efforts to combine rotary and percussion drilling, and the use of power at the bottom of the hole instead of at the top of the drill string.

Several types of percussion-rotary equipment have been tried out. Gulf, for example, has developed a drill in which

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a hammer blow at 600 strokes/minute or more is delivered at the bottom of the hole as the bit slowly rotates. No special bits are required, and the tool can be placed on the conventional drill collar when needed. Diagrams show the Gulf tool, which consists of a reciprocating piston and cyl arrangement powered by the drilling mud. Field tests showed that the tool often gave a higher rate of penetration than rotary, comparing favourably with the turbo-drill. It has been operated for up to 60 hr without withdrawal, and replacements can be carried out on the rig. Bit life with light loads is increased by 50–300%.

Bottom-hole power drilling is provided by the turbo-drill and the electric drill, and these are being studied in several areas. The turbo-drill involves problems of bit wear (due to high speeds) and engine wear, but savings of time are possible if a flexible string could be developed. The bottom-hole electric motor drill is being used in Rumania, where it is lowered, with ancillary equipment, into the hole on a cable, eliminating the use of drill pipe.

Other possible drilling methods under study include hydraulic jets, using steel balls, and the use of a high voltage arc or rocket jets using liq oxygen. C. A. F.

1306. Turbo-drill reverse circulation. B. Petuch. *World Petrol.*, 1957, **28** (9), 60.—Recent research into drilling methods has been concerned mainly with rotary–percussion, magnetostrictive, sonic, and turbo-drill techniques. Of these, only the turbo-drill has been widely used commercially, *e.g.* in Russia, Rumania, Austria, and France.

Turbo-drilling techniques are outlined, and a turbo-drill operating under reverse circulation is proposed. A diagram shows the equipment which it is claimed will permit water to be used to power the turbine and will help to keep the bottom of the hole clean, so reducing turbine and bit wear and increasing the rate of penetration. It is also possible to core continuously. 9 refs. C. A. F.

1307. At only 15½ lb h.p. new mud pump packs 1500-h.p. wallop. Anon. *Petrol. Engr*, 1957, **29** (11), B118–20.—A new mud pump is described in which light-weight castings, 4-cyl V-type construction, high speed operation, and dual crankshafts are included. The pump is of plunger design, thus eliminating pistons and fluid liners. Discharge flow is smooth at high flow rates and pressures with a low ratio of wt to power. A. E. R.

1308. Salt-contaminated drilling muds. W. H. Caraway. *Petrol. Engr*, 1957, **29** (11), B104–10.—Quebracho and caustic may be used to counteract the increase in visc and filtrate loss caused by salt water entering the drilling mud. When further treatments become ineffective the use of low visc sodium cellulose sulphate and commercial grade carboxymethyl cellulose reduce the visc and improve the filtration properties of the mud. A. E. R.

1309. A short-cut method of calculating your cement slurry. J. L. Buster. *Oil Gas J.*, 6.1.58, **56** (1), 112.—Method is given for calculation of slurry wt, vol, and mixing water requirements. A table is provided for the conversion of bulk vol to wt and absolute (solid) vol for 8 commonly-used materials, and the optimum quantities of water needed for mixing with each. Graphs showing slurry wt variations and slurry yield per sack of cement possible with common admixes are shown. J. C. M. T.

1310. Effective inventory control of drilling equipment. J. E. Kastrop. *Petrol. Engr*, 1957, **29** (11), B122–34.—The use of a punched card system as an equipment inventory of a large drilling contracting firm is described. Max efficient use of available equipment without needless duplication is the objective of the system. A. E. R.

1311. Wire-line retractable rock bits. J. M. Camp, J. E. Ortloff, and R. H. Blood. *Petrol. Engr*, 1957, **29** (11), B38–40.—Using surface equipment designed for casing drilling and a retractable 3-cone bit, field tests indicated that drilling costs may be reduced compared with conventional methods. Bit life was slightly less than that of normal bits. A 4-cutter bit was also tested but proved less satisfactory. A. E. R.

1312. Controlled directional drilling. J. A. LeVelle. *Petrol. Engr*, 1957, **29** (11), B77–84.—Basic applications of controlled directional drilling include multiple-hole drilling from offshore platforms, undersea drilling from beaches, wells in inaccessible locations, salt dome exploration, stratigraphic trap exploration, and relief drilling for wells on fire. 3 main types of directionally-drilled holes are described. Hole troubles are more frequent than in straight holes, and penetration is slower. Oil emulsion muds have proved useful in reducing drill-pipe friction, especially where the deflection angle is high. Highly tilted and faulted horizons alternating in hardness make direction control difficult. A. E. R.

1313. Down to 20,000 feet. Anon. *Petroleum, Lond.*, 1957, **20** (12), 455–6.—New package drilling equipment driven by high-powered diesel engines is described which permits ease of handling and drilling to the depth of 20,000 ft. A. E. R.

1314. A 50,000-ft hole isn't impossible. Anon. *Oil Gas J.*, 13.1.58, **56** (2), 62.—A panel of the S. Texas section of ASME recently studied the problems of drilling to 50,000 ft, in response to a Russian claim to have a rig capable of this. High temp (possibly in the region of 450°–875° F) are considered to be the greatest problem. New materials for drilling bits or the use of refrigerated mud would be necessary. Insulating materials in present logging apparatus would be inadequate. Portland-type cements would be useless, but pozzolanic materials might be suitable. Muds for such high temp could probably be produced. 2000-h.p. pumps operating at 5000–6000 p.s.i. might be needed. J. C. M. T.

1315. Record casing string is cemented. Anon. *Oil Gas J.*, 10.2.58, **56** (6), 74.—A string of 13⅜-inch casing has been set to 7898 ft (the longest string of this size ever run) in Anadarko Basin No. 1, Caddo County, Oklahoma. Casing weighs 85 lb/ft; 300-ton elevators and hydraulic power tongs were used. Cementing took 6000 sacks. The operators, Howell & Howell, are aiming at a new depth record of 24,000 ft. J. C. M. T.

1316. Offshore drilling goes deeper. Anon. *World Oil*, 1957, **145** (6), 130.—A new procedure for offshore drilling in water depths up to 1000 ft or more has been developed. The method uses an assembly on the sea bed which is connected to the ship by flexible guide cables. The drilling bit is suspended from the ship on drill pipe which passes through the seated assembly, and the pipe string is sufficiently flexible to allow lateral movement of the ship on which are housed the rig and ancillary equipment. Provision is made for continued circulation of drilling mud, and conventional blow-out prevention and testing procedures can be used.

This technique of drilling from a floating vessel can give considerable savings in costs for offshore drilling, there being no expensive costs for the erecting and removal of platforms. Diagrams show the procedures. C. A. F.

1317. First aluminium offshore drilling structure. Anon. *Petrol. Engr*, 1957, **29** (11), B113–16.—The first prefabricated aluminium offshore drilling platform has been installed in Lake Maracaibo. The platforms are over 100 ft high and weigh *ca* 40 tons/well. Corrosion resistance is good, installation rapid, and salvage of a disused platform easy and economical. A. E. R.

1318. TV helps drill offshore wells. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 125.—An underwater TV camera provided with 2 375-W lamps is being used by Union Oil Co. to assist drilling operations in Californian waters up to 600 ft deep. Monitor room on board the drilling barge allows the critical stages of making conductor pipe connexions on the sea bed, cementing of the drilling base, and locating leaking connexions or breaks in the pipe underwater to be supervised by drillers on the surface. J. C. M. T.

1319. Offshore drilling techniques. J. W. Calvert. *World Petrol.*, 1957, **28** (9), 41.—Offshore drilling techniques in the Texas and Louisiana coastal waters are reviewed. The first offshore wells were drilled from permanent platforms, but mobile units are being increasingly used and these are of 2 basic types: submersible barges with fixed steel pillars on which are mounted the drilling platforms, and the " long legs " type in which the units drive their own piling into the sea floor and then raise themselves to about 40–50 ft above the water. Off the Mississippi river, where there is soft bottom sediment, the submersible barge is used, but off W. Louisiana and Texas the " long leg " is more used because the sea floor is firm. Permanent platforms are still being used in certain areas.

It has been estimated that 75% of all offshore wells are drilled directionally, and this is particularly difficult in the Gulf Coast because of unconsolidated beds. Before the well is spudded, 150–200 ft of conductor string (30–36 inches dia) is driven into the sea floor by a pile driver and up to 1100 ft of 20-inch surface casing is also often used.

Wire line workovers have been introduced for permanent-type completions in which the job can be carried out in 24–48 hr, but the greatest problem in permanent completion is the control of loose sands. All known methods of control have been tried, the most successful being the injection of ground and graded walnut shells coated with plastic. C. A. F.

1320. Calcium surfactant drilling fluids. R. F. Burdyn and L. D. Wiener. *World Oil*, 1957, **145** (6), 101.—Control of mud properties in deep wells is difficult because of the instability of drilling fluid additives and interaction of drilling fluid components at high temp; lime-treated muds, for example, are satisfactory up to *ca* 300° F, but above this control becomes increasingly difficult. Oil base muds above this temp have been used successfully, but they have several disadvantages, and in order to maintain satisfactory mud condition a calcium surfactant drilling fluid has been introduced. The basic requirements for a high temp drilling fluid and the behaviour of the surfactant in lab experiments are discussed. The fluid contains the surfactants (a phenol–30 mol ethylene oxide adduct, defoamant, and emulsifier), calcium sulphate, and a water-loss reducing agent such as sodium carboxymethylcellulose. It is relatively insensitive to electrolytic contamination, causing a minimum dispersion of dissolved solids. The filtrate effectively inhibits the swelling of clays, and there is a higher concn of the Ca ions in the aq phase than that in lime-treated muds; but the use of CMC as the water-loss agent limits the max economic operating temp to 350° F.

Field tests of the mud have been carried out in 4 wells. They are very versatile in use, and with the same combination of surfactants it is possible to change from one type of electrolyte to another during drilling. 18 refs. C. A. F.

1321. Charts speed porosity evaluation of radiation logs. Anon. *Petrol. Engr*, 1957, **29** (11), B95–102.—Although a limestone may be saturated with oil, the porosity value of the limestone determines the economics of production. Charts which were developed in conjunction with a new model neutron/neutron logging tool, designed to reduce error-inducing factors, increase the speed and accuracy of the evaluation of formation porosities. A. E. R.

1322. Reservoir parameters from gamma-ray log. T. P. Cutmore. *Oil Gas J.*, 3.2.58, **56** (5), 97–100.—A combination of γ-ray and micro-log has been found to provide porosity and permeability data sufficiently reliable to replace core analyses in the Cardium sand of Pembina field, Alberta. The micro-log is used to define the porous sand zones. Porosity is obtained from the γ-ray log on the assumption that the porosity is an inverse function of the shale content of the reservoir sand. A porosity/permeability relationship established by core analysis data is then used to determine permeability. J. C. M. T.

1323. Why those low lateral readings? M. Martin and K. S. Kunz. *Oil Gas J.*, 10.2.58, **56** (6), 88–92.—Lateral curves show abnormally low values opposite certain oil-producing sands, even in the absence of nearby resistive beds which might disturb the readings. It is suggested that this is due to the surrounding shales being more anisotropic than the sands. A theoretical analysis and lab tests support this conclusion. In such cases the induction log is the appropriate tool to use. J. C. M. T.

1324. Fundamental problems in quantitative evaluation of electrical drill hole logs. (In German). E. Blum. *Erdöl u. Kohle*, 1956, 9, 834–6.—Determination of the true rock resistance R_t by means of one measurement only, *e.g.* with the laterolog or focuslog is doubtful. Without knowing the resistance R_i of the infiltrated zone and the extension d_i of this zone, determination of R_t of thick strata can lead to considerable error. R_t acting against R_t, and d_i may affect R_t separately or simultaneously. If it be considered that d_i must possess a definite min val in order to get a useful val of R_t for obtaining the formation resistance factor F, it appears necessary to obtain quantitatively dia d_i and resistance R_i of the infiltrated zone to permit the necessary corrections. Therefore, R_t determination involves 3 measurements—with available instrumentation—of varying pen depth and different current flow in the borehole. R. T.

1325. New device for geologists in the oilfield—well sample indicator. (In German.) G. Schmitz. *Erdöl u. Kohle*, 1956, **9**, 837–8.—The " Sample Lagger " recently developed enables an exact correlation of the drilling samples being taken to their original formations. The instrument described and illustrated is constructed as a pump stroke counter. The pump strokes necessary to bring the drilling mud to the surface is calc approx from the formula:

$$a = \frac{V_B}{V_p\ (1 - k_s)}$$

where V_B = vol of borehole with rods, V_p = pump stroke vol per rev (90% eff), k_s = average sinking velocity factor. Tables and diagrams are available for determining pump stroke No. for different depths. R. T.

1326. The well that changed the world. C. G. Hamill. *API Quart.*, Winter 1958, 7–11.—A vivid description of the discovery of the Lucas gusher on Spindletop, near Beaumont, Texas, on 10 Jan. 1901. This was the discovery of the greatest field the world had ever known, and the herald of the petroleum age. R. T.

1327. Pecos test may top record. Anon. *Oil Gas J.*, 6.1.58, **56** (1), 73.—Phillips Petroleum Co. have decided to deepen their wildcat 1-EE University, in Central Pecos County, Texas, to 23,000 ft. Well is at present in Simpson formation at 21,207 ft; objective is the underlying Ellenburger. Commercial shows were indicated in the Wolfcamp below 8600 ft. Deepest production in Texas is from the Ellenburger at *ca* 15,000 ft at Puckett, *ca* 20 miles SE. from present test. J. C. M. T.

1328. Wildcatting climb halted in '57. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 150.—The number of wildcats drilled in the U.S.A. fell from 13,034 in 1956 to 11,739 in 1957. This is the first drop since the war. Wildcats accounted for *ca* 21% of all wells completed—a 1% drop over 1956. Success ratio of wildcats drilled in 1957 was 10·9% oil, 3·3% gas, 85·8% dry. The dry-hole ratio is the highest for 5 years. Highest oil success ratio was 21% in Oklahoma. J. C. M. T.

1329. Three basins share wildcat success. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 214.—California's 1957 exploratory success was centred in the San Joaquin Valley, Ventura basin, and Los Angeles basin. Increased drilling activity is predicted for the offshore region of Santa Barbara and Ventura Counties, the residential area of Los Angeles, and on the W. side of Kern County field. J. C. M. T.

1330. Texas' deepest well. E. McGhee. *Oil Gas J.*, 3.2.58, **56** (5), 80–4.—1-CS University was drilled by Pan American to 21,687 ft in 15 months at estimated drilling cost of $1,200,000. There were no lost circulation or blow-out troubles and little fishing. Drawworks used were National 23 — 10½ steam unit converted to electric drive with 2 300-h.p. motors. 2 400-h.p. motors powered the mud pump. D.c. current was supplied by 2 1000-h.p. butane-fuelled I.C. engines driving 3 250-kW generators.

Casing programme was 22-inch conductor pipe to 70 ft; 16-inch casing to 1790 ft; 10¾-inch to 5825 ft; 7⅝-inch to 16,478 ft; remainder of hole drilled with 6½-inch bit and uncased. Low pH muds were used throughout. Below 16,478 ft a gel-chemical, oil-emulsion mud of 10·6–10·8 lb/gal and visc 75–140 sec/1000 cc was used. Stand-pipe pressures rose to a max of 3800 p.s.i. at T.D. Weights on the bit were as high as 90,000 lb between 5825 and 16,478 ft, 15,800 lb in the deeper hole. Vanadium-steel drill pipe was used in upper half of drill-string when drilling below 11,000 ft. Hole deviation increased gradually to 10°–12° at T.D. At 21,687 ft the bit stuck on bottom and was not recovered; after backing off at 20,100 ft the hole was plugged to 18,400 ft, and D.S.T. carried out in the open hole above. Bottom-hole temp was estimated as 336° F. J. C. M. T.

1331. Drilling the world's hottest well. R. E. Keen. *Petrol. Engr*, 1957, **29** (11), B21–9.—An exploratory well in Texas has been drilled to over 15,000 ft, and the unusually high bottom-hole temp exceeded 460° F. To overcome this difficulty, a new type of low sodium content drilling mud was developed containing an emulsifier which supplemented fluid loss control properties. Penetration rates using the low sodium mud were believed to be in excess of normal drilling rates. Difficulties were experienced with conventional logging due to the high temp; however, a γ-ray neutron log was run successfully. Special lubricants were used, but maintenance and service of the equipment were affected and completion of the well was hindered by breakdowns. A. E. R.

1332. Problems in drilling a deep slim hole. V. R. Williams. *Petrol. Engr*, 1957, **29** (11), B42–50.—In an area of high drilling costs, a slim hole was drilled to 9160 ft. Lost circulation, a downhole fire, and other difficulties were encountered; however, drilling costs were reduced, due to a small rig, fast penetration, and small casing. Air drilling proved successful in one section with penetration rates up to 20 ft/hr. A. E. R.

1333. Reduced pressure drilling. R. A. Bobo and G. S. Boudreaux. *Petrol. Engr*, 1957, **29** (11), B56–68.—Penetration rates and bit savings were high during drilling with air. The improved performance is attributed to a relief of the vertical axial stress in the formation beneath the bit. Prolific water zones cause difficulty, and must be sealed off. Aerated muds were used successfully, except in shale, to remedy loss of circulation and increase penetration rates in areas where air drilling was disadvantageous. Oxygen corrosion of the drill string was prevented by using a saturated lime soln. A. E. R.

1334. Air drilling possible through long intervals of open hole. R. E. Larson and O. Peters. *Oil Gas J.*, 10.2.58, **56** (6), 105.—Air drilling in wildcat 1 Tribal, Glacier County, Wyoming, was carried to 9072 ft in an open hole, showing an appreciable saving in time and cost over conventional drilling in nearby wells. This well was drilled in the disturbed belt of the E. front of the Rocky Mountains, where steep dips in the younger rocks frequently cause drilling difficulties. Main object of using air in this instance was to achieve reasonable penetration rates with low bit weights, thus keeping hole straighter. Main air-drilled part of hole was drilled with 9-inch bits, 6000–7000 lb on bit, rotary table speed of 140 rev/min, air pressure of 90 p.s.i., and circulation rate of 3000 cu. ft/min. Unexpected feature was hole enlargement, the hole drilled averaging over 14 inches dia. Main difficulties encountered were fatigue failures of drill-pipe, wear on the stripper rubbers of the rotating head, clogging of dust in the hole when drilling water zones, and difficult geological interpretation of samples. J. C. M. T.

1335. New air and gas drilling concepts. P. L. McLaughlin. *World Petrol.*, 1957, **28** (9), 46.—It is thought that the economic limits of existing rotary equipment have been reached, and there is a need for more efficient and cheaper drilling methods. Air or gas, if they can be used, are the ideal drilling media, regardless of the size and type of bit used, and field tests have shown that penetration rates with air are often twice those obtained with mud, with reduction in well costs by 25–50%.

Air drilling is being increasingly used, and there are a number of factors which favour the use of air; these include: (1) porous formations (involving lost circulation with conventional fluids); (2) hard formations in which air can give a higher penetration rate; (3) cold climates when muds are liable to freezing; and (4) areas with poor water supply. In addition, uncontaminated cores can be obtained and no formation testing is required, as fluids can be brought to the surface by blowing the hole. There are, however, limitations to air drilling; the removal of cuttings, for example, and gumming up can be a problem. There is also a risk of subsurface explosions and the danger of blowouts. 8 refs. C. A. F.

PRODUCTION

1336. Oil production below the bubble-point for reservoirs under water drive or subjected to water flooding. J. P. Munier-Jolain. *Rev. Inst. franç. Pétrole*, 1957, **12** (9), 929–35.—In operations at Bradford and Allegany gas was injected into the formation after a period of water flooding, and on resumption of flooding the indications were that the final recovery would be greater than that suggested by the trend before the gas injection. Some producers contended that there was an increase of 10–15%.

In experimental studies in some cases a gas saturation in the specimen was created by gas injection into the liq-saturated specimen, followed by the injection of gas-saturated oil until free gas was no longer removed by the oil. In other cases oil above the bubble-point was injected into the specimen, and on partial pressure reduction gas was set free. Water flooding was then carried out, the water pushing out a bank of oil and then washing the oil zone. It seems that with initial saturations of mobile gas of 20–30%, corresponding to 15% at the start of flooding, the gain in recovery was 3–7% of the pore vol for light oils, and 8–10% for oil of visc exceeding 20 cP.

Some experimental work has indicated a max recovery of

oil for a gas saturation of *ca* 15% at a low rate of flooding, but a minimum recovery at about the same saturation for a much higher rate of flooding.

It is likely that the improved oil recovery is linked with the displacement by water of a given vol of non-wetting phase, irrespective of whether it is oil or gas. On this basis the pressure on a reservoir could be dropped quickly below the bubble-point, followed by constant pressure using natural or artificial water flooding. This is contrary to classical production procedure. G. D. H.

1337. Study of oil recovery by dissolved gas drive. The Bled Khatara accumulation. X. Reverdy. *Rev. Inst. franç. Pétrole*, 1957, **12** (11), 1143–52.—Various assumptions were made in order to compute the recovery below the bubble point by dissolved gas drive. A mean curve was taken for the relative permeability-saturation relationship, and a series of curves relating producing gas/oil ratio and saturation were derived for pressure values from the bubble point downwards in steps of 1 kg/cm². Next, 2 slightly different states were considered and for unit reservoir vol the oil content at the second state was estimated, that for the first state being known. By material balance considerations the subsurface vol of the gas released but not produced was found, and this with the remaining liq should have filled the space considered. If this result was not achieved, a satisfactory value was obtained by trial and error. This process was repeated for successive pressure values and extrapolated to atm pressure. It was estimated that 10% of the oil in place at the bubble point would be produced. This compares with 8% expected by dropping from the initial pressure to the bubble point. However, 10% is optimistic because the reservoir is not homogeneous and the permeability data were for the more permeable cores. Moreover, successive states of equilibrium were considered, but flowing pressure gradients would give high gas saturation near the wells.

The basic data and derived tabulations are given, as well as the method of finding the gas solubility as a function of pressure. G. D. H.

1338. Crude oil from well 2 of the new Egyptian oilfield Belayim. (In German.) W. Machu and F. E. Zahaby. *Erdöl u. Kohle*, 1956, **9**, 852–3.—The new, very promising oilfield Belayim on the Sinai Peninsula, on the E. coast of the Gulf of Suez, was discovered in 1955. The oil region belonging to the National Petroleum Co. is a purely Egyptian concern. At present 6 wells are producing, well 2 with 140 tons/day being the most productive. Important properties of the oil and results of atm and vac dist for gasoline, kerosine or gas oil, diesel power fuel, wax, and bitumen are tabulated. The oil, the heaviest found up to now in Egypt, is sour, with a very unfavourable set. pt., so that pipeline transport in winter is possible only on admixture with Feran crude. R. T.

1339. P.D. meters for LACT. E.Mc Ghee. *Oil Gas J.*, 13.1.58, **56** (2), 74.—A lease-automatic-custody transfer unit owned by Cities Service Oil Co. in Gray County is the first of its kind in Texas to use positive displacement meters in unattended operation and without duplicate measurement of the crude in a tank. Oil is produced automatically from 42 pumping wells on 3 leases, metered, heated if necessary, and the B.S. & W. separated. Each lease is switched off automatically when the month's allowable output is reached. Fail-safe devices are fitted. In 2 months' reliable operation the unit has handled 31,046 brl of crude. J. C. M. T.

1340. Automatic well testing. H. A. Saye. *Oil Gas J.*, 6.1.58, **56** (1), 102.—System consists of equipment to divert wells sequentially through metering equipment together with control equipment to programme the tests and record the resultant data. It is of use where accuracy is important and frequency of tests is more than can be handled conveniently by lease personnel. J. C. M. T.

1341. Subsurface safety device. L. M. Wilhoit and P. S. Sizer. *Oil Gas J.*, 6.1.58, **56** (1), 119.—A safety device for incorporation in offshore wells is described. It consists of a valve in the tubing hanger assembly which can be closed hydraulically from the surface. The valve is closed automatically in the event of accidental damage to the Christmas tree or flow line. When open, it has a full-bore aperture, allowing many downhole operations to be performed without its removal. It can, however, be removed if necessary, using conventional wire-line equipment. J. C. M. T.

1342. What can be done about gyp depositions? A. Gibbon. *World Oil*, 1957, **145** (6), 140.—Production decline due to mineral deposition around the well bore has been a serious problem in many wells, but the use of 12–40 mesh granular polyphosphate has been successful in reducing the deposition. The deposits are usually $CaCO_3$, $CaSO_4$, or $BaSO_4$, and may be due to the mixing of formation brines. The polyphosphate, which is injected during fracturing treatments, acts as a sequestering agent, inhibiting crystal growth by retaining insoluble cpds in colloidal suspension until they are produced from the well.

The results of field tests are described, and diagrams show production histories of treated wells. C. A. F.

1343. Damage ratio determined by drill-stem test data. H. K. van Poollen. *World Oil*, 1957, **145** (6), 139.—Well-bore damage is due to a zone of reduced permeability immediately surrounding the well bore, and it can be caused by drilling fluids, gas released from the formation fluid, or by physical distortion by drilling tools. The damage ratio is defined as the ratio between the theoretical and actual productivity index at the time of measurement, and methods have been described for determining its value. These can be unsuitable for use at the well, and an approximation is therefore proposed for use when a dual closed-in pressure is available, the initial closed-in pressure approximating the static reservoir pressure. C. A. F.

1344. Tritium, newest tool for tracing reservoir flow. R. E. Fearon. *World Oil*, 1957, **145** (6), 144.—Tritium (radioactive hydrogen) has proved a valuable tool for research into reservoir flow. It is used as a tracer and has several advantages over other radioactive tracers. It is relatively cheap, and is safe in handling because its radiation consists of a low order β-ray emission. A unique advantage is that it is chemically identical with hydrogen and so can be " blended " into any cpd containing hydrogen, as in brine. It is also fairly stable with a half-life of *ca* 12 years.

The detection apparatus uses specially designed very sensitive geiger counters.

In the field, fluid flow is traced by injecting radioactive tracer material into the producing zone and determining the time for its travel from the injection well to selected check points. 4 refs. C. A. F.

1345. Two ways to better oil recovery. C. D. Russell. *Oil Gas J.*, 10.2.58, **56** (6), 117–21.—2 solvent extraction secondary recovery processes, potentially capable of recovering more than one brl oil/brl LPG are considered in this survey, which is supported by 30 refs. In the Enriched Gas Injection method wet gas is injected as the driving fluid. The LPG in the gas stream condenses and dissolves crude oil remaining in the pores of the reservoir after primary recovery. Lab tests showed that enriched gas containing 18% propane recovered nearly 100% of the oil in place, against a max of 50% recovery using dry gas. In the Gas-Driven Solvent Bank process a slug or bank of LPG is driven through the reservoir by the injection of dry gas behind it. The flow rate must be slow

enough to allow the solvent to mix with the oil, and fast enough to prevent the slug spreading by diffusion. In lab tests oil recovery approached 100% when the vol of propane used was 30% of the recovered oil vol, over 90% with 15% of propane. Flooding in a vertical direction (solvent on top) is more efficient than horizontal flooding, suggesting the method is especially suited to reservoirs in steeply dipping beds. *Ca* ½ the oil remaining after water flood operations could probably be recovered by solvent recovery. Some results of a field test in a sand in Seminole County, Oklahoma, are given.
J. C. M. T.

1346. Interpretation of production and formation tests: determination of the "skin effect." J. Jaisson. *Rev. Inst. franç. Pétrole*, 1957, **12** (11), 1123–42.—The skin effect arises from changes in the permeability of the producing formation immediately around the borehole as a result of drilling and completing the well. Relationships are derived for flow when this altered zone is present, and the coeff of the skin effect is defined. The relationships derived include that for pressure build-up and for transient flow. Comparison of the coeff of the skin effect before and after fracturing, acidization, etc., indicates whether benefits have resulted.

Equations are developed which involve the diffusivity, using a series of different consecutive rates of flow, and also the pressure evolution at the bottom of a well after starting flow at a constant rate.

Under favourable conditions drill-stem test data can be used to obtain data on reservoir pressure, permeability, productivity index, and the skin effect. For drill-stem tests it may be important to develop the results quickly, but the information on some points may not be highly satisfactory in the case of some exploratory wells. The theory is presented for the pressure evolution during the production period and on shutting in. The means for obtaining the potential, the permeability, and the skin effect are indicated. Drill-stem test equipment with 2 valves for opening may give a reading for the formation pressure before the normal flow period is begun.

In each case there is an indication in the discussion of the conditions which must be satisfied for obtaining good results.
G. D. H.

1347. Survey of the determination of allowables. F. Poimboeuf. *Rev. Inst. franç. Pétrole*, 1957, **12** (9), 919–28.—When it was recognized in the U.S.A. that excessive producing rates could lead to smaller ultimate recoveries, the concept of a max efficient rate arose, *i.e.* the max rate practicable without curtailing recovery. However, this rate is far from easy to define. It is possible that the recovery mechanism may be an important factor in fixing this rate.

In gas-cap drive the aim must be to keep the gas/oil ratio at reasonable levels, because the gas is an important source of energy. The gas/oil contact should fall evenly, and the pressure gradients should be such as to prevent water coning. In dissolved gas-drive, so long as only liq enters the well recovery is not rate dependent. Experimental studies have indicated that for non-uniform porous limestones recovery may be increased at high rates; nevertheless, rates should not be such as to cause water coning. This is a complex phenomenon and can be studied mathematically only under simplifying assumptions. Model studies have confirmed the general accuracy of the solutions.

Sometimes it is considered that water-drive must be kept in check to permit the full action of capillarity and to allow efficient sweeping. Some experiments, however, show greater recoveries at high rates. In irregular beds rapid water advance may cut off oil. There appears to be a certain gas saturation for max oil recovery by water drive.

It appears that the only clear-cut rule regarding max efficient rate relates to water coning. The producing mechanism is important, and restriction of rates in early days may be necessary to determine the mechanism and its efficiency. The allowance can then be fixed, although never precisely. Experiments with several wells while others produce at moderate or fixed rates may help. G. D. H.

1348. Relationships between techniques and economics in the production of oil. J. Petitmengin. *Rev. Inst. franç. Pétrole*, 1957, **12** (11), 1153–60.—The complexity of geology precludes statistical comparisons as a reliable basis for predicting the results in the search for oil, and there is no definite link between the size of an accumulation and the effort and cost involved in its discovery. However, reservoir engineering is much more precise. As the number of wells increases, the behaviour of the field becomes more predictable and note can be taken of economic factors, with the consequence that views become clearer on the best use of capital. The best propositions can be chosen.

If R_n is the revenue in the nth year in the future and D_n the expenses, I the initial investment, and i the rate of interest, the present value of the operation is

$$B = \sum \frac{R_n}{(I+i)^n} - I - \sum \frac{D_n}{(I+i)^n}$$

The curve passes through a max, and that point gives the life of the operation, while the point at which $B = O$ gives the pay-out.

In a sane economy only projects will be undertaken which give a better return than bank interest.

In some discussions plots of B against I for different programmes may be of value in selecting the best technique.

The elements of the calculations are given for a simple case where the production decline is logarithmic. G. D. H.

1349. Fracturing 89% successful. G. R. Locker. *Oil Gas J.*, 13.1.58, **56** (2), 94.—37 wells in the Clearfork reservoir of Fullerton have received fracture treatment. An increase of 156,000 brl in the allowable production over 6 months has resulted, the total production for this period being 213,000 brl.
J. C. M. T.

1350. World output drops again. Anon. *Oil Gas J.*, 6.1.58, **56** (1), 85.—Free world crude production declined for the fourth month in succession in Oct. 1957. Total was 15,338·1 thousand against 15,391·6 thousand b.d. for Sept. Russian production increased from 2000·0 thousand in Sept. to 2270·0 thousand b.d. in Oct. Far East production passed an average of half a million b.d. for the first time. J. C. M. T.

1351. Louisiana offshore has banner year, expects another. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 218.—In 1957 671 wells were drilled offshore in Louisiana and 23 new fields found. Only 31% of the wells were dry. Multiple sands and completions are typical of the region. Exploration and development drilling were scattered over a wide area. J. C. M. T.

1352. Phillips cuts offshore producing cost. Anon. *Oil Gas J.*, 6.1.58, **56** (1), 79.—An offshore storage platform, in which the tanks are used as part of the supporting structure, has arrangements for the remote control by one operator of up to 32 wells on 4 adjacent platforms. Wells may be opened or shut-in individually or simultaneously, the production rate of any well changed, all well-head and header pressures read, and the output of any well diverted from the flow lines to test line, all from the control house, using electrical power. Provision is made for installation of automatic custody transfer equipment. J. C. M. T.

1353. Where the nation's oil is stored. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 163.—The proved reserves of crude oil and

condensate of *ca* 500 of the larger oilfields of the U.S.A., as of 1.1.58, are tabulated. Cumulative production, number of wells, and acreage are also given. J. C. M. T.

1354. The North: boom on the prairies. J. S. Peach. *API Quart*, Winter 1958, 19–23.—W. Canada's first oil and gas field, Turner Valley, was discovered in 1911 by intelligent observance of bubbles rising through a stream. The impact on economic life was remarkable. The Alberta Petroleum and Natural Gas Conservation Board was formed, whose expenses were borne by the oil operators, and whose rulings were observed. From being the poorest risk in the British Empire, Canada has become a safe risk and has attracted much U.S. capital. Much credit is due to the Alberta provincial government for the status of Canada's petroleum industry to-day. After Imperial Leduc No. 1 blew-in on 13 Feb. 1957, capital investment was forthcoming for a new industrial age for the nation. To seek an outlet for the vast oil reserves—by the end of 1950—the world's longest pipeline was in operation, transporting *ca* 100,000 b.d. of Alberta crude to the E. Canada markets. Natural gas reserves exceed 24 trillion ft³. The Trans-Canada gas pipeline is being built from Alberta to Montreal. The W. coast transmission line is in operation. Canada has a strong and vigorous outlook and is capable of supplying her own needs. However, she is not doing this because of the many geographical features which enter into the marketing pattern. R. T.

1355. Liquid reserves 39·67 million barrels. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 160.—The net gain in reserves in the U.S.A. in 1957 was 857 million brl crude and 267 million brl of natural gas liq. 3 areas—W. Texas, Rocky Mountains, and S. Louisiana, were mainly responsible for the increase. On 1.1.58 the proved U.S. reserves stood at 33,500 million brl crude and 6169 million brl of natural gas liq. Reserves by states are tabulated. J. C. M. T.

OILFIELD DEVELOPMENT

1356. Worldwide drilling activity high. Anon. *World Petrol.*, 1957, **28** (10), 72.—World drilling activities outside the U.S.A. in 1957 are briefly reviewed by areas, with emphasis on important discoveries. In the W. Hemisphere discoveries and developments and drilling data are noted for Alaska, Canada, Mexico, Jamaica, Cuba, Costa Rica, Guatemala, Honduras, Nicaragua, Venezuela, Argentina, Bolivia, Brazil, Surinam, Peru, and Colombia. In the E. Hemisphere European activities are reported for Austria, Denmark, France, Germany, Greece, Italy, Sicily, Holland, Portugal, and Spain; in the Middle East for Afghanistan, Bahrain, Egypt, Iran, Israel, Jordan, Kuwait, Muscat and Oman, Lebanon, Neutral Zone, Qatar, Saudi Arabia, Syria, Turkey, and Yemen; in Africa for Algeria, Tunisia, Sudan, Libya, Angola, Belgian Congo, French West Africa and Equatorial Africa, Gabon, Zanzibar, and Somaliland; and in the Far East for India, Japan, Korea, Pakistan, Australia, Borneo, Papua, New Guinea, Indonesia, and the Philippines. C. A. F.

1357. Canadian drilling active despite drop in offshore crude sales. L. O. Rowland. *World Petrol.*, 1957, **28** (10), 90.—Discoveries and development in Canada during the first half of 1957 are outlined. There has been considerable expansion of activities in Saskatchewan, where drilling increased by nearly 100% over 1956, and production had increased to *ca* 110,000 b.d. by June 1957. Total production of the W. provinces for the first half of 1956 was 96,647,884 brl, 24% more than in the corresponding period of 1956. Saskatchewan showed a marked increase in number of completions, as compared to Alberta, where a smaller number of wells were completed.

In SE. Saskatchewan the discovery rate, although not as high as in 1955 and 1956, showed a success ratio not much below 1 in 3, the record of the previous years. 3 major fields, Steelman, Midale, and Weyburn have been confirmed to have recoverable reserves of well over 100 million brl each.

Work on pipelines in W. Canada during the first half of 1957 is noted. C. A. F.

1358. Appraisal of the Canadian future. Anon. *Petrol. Press Serv.*, 1958, **25**, 53–6.—Alberta has felt the recent general slackening of growth in oil demand, due partly to competition from Saskatchewan, and new U.S. restrictions on oil imports into the Pacific NW. Basically, it reflects current limited marketing range from land-locked Albertan fields. At the present level of prices, tariffs, freights, etc., Albertan crude is only just competitive with alternative sources of supply in its most expansible markets. New competition may arise from British Columbia and Alaska, both potential supply sources for the U.S. W. coast. However, the long-term prospects for the W. Canadian oil and natural gas industry are unquestionably good. This long-term outlook is surveyed in an interesting study by J. Davis, just published under the auspices of the Gordon Commission. Production of 3 million b.d. of crude by 1980 is anticipated, if demand in U.S. markets should grow at a rate > the assumed 4% p.a. Canada's own future consumption of domestic and imported oil is predicted to rise to 1·9 million b.d. by 1980. Well-head prices of Canadian crudes are much lower than comparable prices in the U.S.A. and Venezuela, because of transport distances from markets. Over the long term Canadian production costs may rise, but meanwhile, all unit costs in the U.S.A. are likely to rise significantly faster. Also there is wide scope for increasing gas sales both in Canada and the U.S.A. However, long-term commitments cannot be made without endangering Canada's domestic needs after 1980. R. T.

1359. Exploration and drilling in Venezuela. N. R. van Middlesworth. *World Petrol.*, 1957, **28** (7), 81.—Intensive exploration is being carried out in the Lake Maracaibo area of W. Venezuela, where a number of operators are starting drilling on new concessions. The area comprises a rectangle *ca* 40 miles by 30 miles extending from the E. side of the lake to over ½ the distance across. Total area is 350,175 acres.

Wells in the lake are drilled to 8000–11,000 ft; the cost of a first well would be *ca* $1 million, including a platform at *ca* $200,000 and contract drilling at *ca* $4000/day. If successful the well may find thick Eocene oil sands with 1000–2000 b.d. potential production.

There has been less wildcatting in Venezuela recently; in the first quarter of 1957, 532 wells were drilled, of which *ca* 45 were wildcats.

Recent developments in E. Venezuela, the Gulf of Paria, and Barinas are noted. C. A. F.

1360. Venezuela has best year. Anon. *Oil Gas J.*, 27.1.58, **56** (4), 142.—Venezuelan crude oil production during 1957 averaged 2,785,700 b.d. This is 13·3% higher than in 1956, and accounted for 18% of free world crude oil production. J. C. M. T.

1361. Barinas oil search rewarded. Anon. *World Petrol.*, 1957, **28** (7), 102.—3 fields have been found so far in the Barinas area of SW. Venezuela where exploration has been carried out since the 1920s. These are the Silvestre (1947), Silvan (1949), and Sinco (1953) fields. Lab and field work have been carried out to determine the best method of obtaining max ultimate recovery, and recent drilling has been aimed at proving productive limits and checking seismic structure.

Following aerial surveys for routing a pipeline, a 20-inch, 212-mile line has been built from Barinas to Puerto Cabello on the Caribbean coast. A gathering system has also been planned.

Future prospects of the industry in the area depend on the finding of more fields with larger reserves. C. A. F.

1362. Big-inch crude pipeline "frees" Barinas basin oil. H. T. Brundage. *World Oil*, 1957, **145** (6), 171.—A new big-inch pipeline from San Silvestre in the Barinas basin of SW. Venezuela to the port of Puerto Cabello was due to start operating in Nov. 1957. It is a 20-inch line, costing some $26 million, and extends for 212 miles. This is the first outlet for oil from the area, and it is expected that it will stimulate further exploration.

The capacity of the line is estimated at 102,000 b.d., operating under 1000 p.s.i., but initial flow will be *ca* 50,000 b.d. 3 fields will serve the line: Silvestre, Silvan, and Sinco. At Sinco *ca* 32 producing wells have been completed, and at Silvestre and Silvan over 20 wells are producers.

Silvestre and Sinco fields have 3 oil sands of Eocene and Cretaceous age, and both are anticlines with much cross faulting. C. A. F.

1363. French oil industry—progress review. T. H. Skeet. *Petroleum, Lond.*, 1957, **20** (11), 413–16.—Recent oil and gas discoveries in France and N. Africa are reported. The Hassi Messaoud field is estimated to contain reserves of *ca* 700 million tons. Production occurs from a 360-ft oil-bearing zone at *ca* 11,000 ft. Light crudes have been discovered elsewhere in N. Africa up to 1700 ft deep; however, development drilling is required to evaluate the reserves. The financing of oil exploration and development has been expedited by the French Government, and large reserves of natural gas at Lacq may now be utilized, due to the completion of a desulphurization system. A. E. R.

1364. France seeks oil sufficiency. G. Henry. *World Petrol.*, 1957, **28** (10), 63.—It is expected that within a few years oil consumption in France will be largely met by French-produced oil. Exploration and development in France and in her overseas territories are described with their legal aspects, and it is shown that the progress in discovery of oil and gas during 2 5-year periods since the last war indicates that substantial additions to existing production and reserves will be made. The first properly equipped search began in the first 5-year period, 1946–50, and the Lacq Superior field was found. During the second period, 1951–55, exploration was intensified and the Parentis and Lacq fields were found, together with indications in Gabon and the Sahara. In the third period, which extends until 1960 and involves an investment of $714 million, commercial oil has been found in the Sahara, and there have been further developments in France.

In 1946 annual production was *ca* 54,000 tons, and this has now increased to over 1 million tons. It is expected that, during the period 1956–60, 100 million tons of new reserves will be found.

The structure of the main prospecting companies and their fields of operation are discussed, and diagrams show concession holdings and areas under application. C. A. F.

TRANSPORT AND STORAGE

1365. Petroleum transport—review and prospects. J. Grindrod. *Petroleum, Lond.*, 1957, **20** (11), 409–12.—W. Europe imports much of the Middle East oil production. The awakening of Arab nationalism has produced friction and a boom in tanker building, with a trend towards larger ships as much as 65,000 tons dw, which are capable of economically using the Suez Canal or the Cape route. Transport of oil by pipeline is cheaper than by sea if distances are reduced, which has led to the planning of a 40 million tons p.a. pipeline connecting the head of the Persian Gulf with the E. Mediterranean coast. A. E. R.

1366. Nomographs for rapid gauging of cylindrical tanks with flat or dished ends. M. Darré. *Chim. et Industr.* (*Génie Chim. suppl.*), 1958, **79**, 52–5.—Mathematical expressions are derived, whence nomographs can be constructed; examples of the latter are reproduced. V. B.

1367. The world tanker fleet. Anon. *Petrol. Times*, 28.2.58, **62** (1580), 182.—Extracts are given from the Annual Review of John I. Jacobs & Co. Ltd, and show flag changes, new construction, deliveries, ownership of new construction, size, speed, propulsion, and tanker freight market. A table gives world tanker fleet at end of 1957 by country. G. A. C.

1368. Tecumseh fills need for more crude into Ohio. W. M. Bellairs. *Petrol. Engr*, 1957, **29** (11), D33–5.—Additional carrying capacity of crude oil from Chicago to Ohio has been provided by a 200-mile, 20-inch line at present capable of handling 100,000 b.d. at a max pressure of 1000 p.s.i. At the discharge side of the single pumping station the wall thickness of the pipe is increased. Cathodic protection is combined with a coating of asphalt enamel and glass fibre covered with kraft paper. A. E. R.

1369. First pipeline from Four Corners area. F. H. Love. *Petrol. Engr*, 1957, **29** (11), D38–44.—The Aneth and Bisti areas have high estimated reserves, and now a 750-mile system is under construction to Los Angeles. Some of the pipe was laid in desert areas subject to occasional heavy rainfall which requires adequate burial of the pipe. Blasting operations were necessary in rock areas. Coating consists of asphalt and coal-tar enamel wrapped with glass fibre and asbestos felt. A. E. R.

1370. Electrical insulation of underground pipelines. Pt 2. G. B. McComb. *Petrol. Engr*, 1957, **29** (11), D45–9.—Additional material is given on the effect on electrical insulation of moisture penetration or absorption by the pipe coating. An appreciable increase in moisture absorption occurs in non-coal-tar coatings between 2 and 5 years, while coal-tar enamels absorb much less water at a decreasing rate up to 15 years. Water absorption tests with and without measurements of electrical resistance are described. The most absorbent coatings become spongy, and the deterioration is more rapid in arid areas where temp are high and the soil moisture content is low. A. E. R.

1371. Trans-Canada makes rapid strides in 1957. L. O. Rowland. *Petrol. Engr*, 1957, **29** (11), D51–68.—The 2250-mile natural gas pipeline from the Alberta gas fields to E. Canada is well advanced with the first 585-mile section complete and delivering gas. The line passes through swamp areas and granite formations which require time-consuming rock drilling and blasting. Many concrete river weights were used in the swamp areas, and tractor operation was hazardous. The line was coated with coal-tar enamel wrapped with glass fibre and then kraft paper. Several river crossings were completed. A. E. R.

1372. Material procurement for compressor station construction. C. C. Lazzari. *Petrol. Engr*, 1957, **29** (11), D70–80.—A programme to purchase and expedite compressor pipeline station material is set up so that the arrival of materials on the job site co-ordinates with construction requirements, thus purchasing and construction time are reduced. Economic conditions affect the availability of equipment. A. E. R.

1373. Zinc bracelets protect undersea line. D. M. Taylor. *Petrol. Engr*, 1957, **29** (11), D81–6.—Zinc anodes weighing

1000 lb are fitted around a new Louisiana offshore pipeline every ½ mile. The anodes are designed to protect the line for 40 years and fit flush with the concrete coating, so that the line may be laid in a ditch which is formed by high-pressure jets that do not damage the anodes. The middle portion of the line between the shore and the offshore platforms is protected by the zinc anodes due to the high voltage requirement of additional cathodic protection of this section. A. E. R.

1374. West Coast system completed ahead of schedule. L. O. Rowland. *Petrol. Engr*, 1957, **29** (11), D100–12.—A 649-mile, 30-inch gas pipeline has been completed in 2 years from the Peace River gas fields to near Vancouver over the Canadian Rockies. Initial throughput is 300 million cu. ft/day with plans to double this. Steep slopes throughout the job slowed progress and necessitated the winching of equipment. A number of suspension bridges were built to carry the line over major rivers. A. E. R.

1375. It pays to take care of your cable. J. B. Sinclair. *Petrol. Engr*, 1957, **29** (11), D120–1.—Cable used in the pipeline construction industry lasts longer with proper installation and maintenance, for which cost-saving hints are given. A. E. R.

1376. Movement of oil by pipeline. J. W. Jones. *Petroleum, Lond.*, 1957, **20** (11), 406–8.—Pipelines have become increasingly important in the economics of the transportation of crude or products. Design and construction methods and economic considerations are briefly discussed. A. E. R.

1377. Protect pipes with an aluminium jacket. Anon. *Oil Gas J.*, 10.2.58, **56** (6), 151.—Standard Oil Co. have purchased $250,000 worth of pipeline insulation lined with mineral wool and weatherproofed with sheet aluminium to maintain temp of fuel oil and steam being piped 6 miles from Esso Bayway refinery to Linden, thus saving more than $500,000 p.a. G. A. C.

1378. Predicting pressure drop in gas-condensate pipelines. A. L. Berry and B. L. Moreau. *Oil Gas J.*, 17.2.58, **56** (7), 102.—From a study of data on 4 16-inch high pressure 2-phase pipelines handling sour gas for Westcoast Transmission Co. Ltd in British Columbia, an empirical formula has been developed for determination of total pressure drop for a gas-gathering system through rolling terrain. G. A. C.

1379. Dual-purpose pipeline designed for both transport and storage of high purity ethylene. Anon. *Oil Gas J.*, 10.2.58, **56** (6), 100.—The line, which crosses Gulf Coast marshland, was built by Petroleum Chemicals Inc. from its Lake Charles, Louisiana, plant to contract customers near Orange, Texas, and operates at varying pressures. G. A. C.

1380. Different formulæ for pressure drops in pipelines. Application to Le Havre–Paris pipeline. J. B. Capdeville. *Rev. Inst. franç. Pétrole*, 1958, **13**, 71–82.—Various formulæ for pressure drops in long pipelines are critically examined. Expt data obtained with 10-inch pipes destined for the Le Havre–Paris pipeline and operational results for this pipeline fitted the Hydraulic Institute curve derived from Colebrook and White's data. Roughness of the pipe wall was checked during operation by determining the coeff C in a modified Hazen and Williams formula. W. A. M.

1381. Parallel three unit compressors power Texas Eastern's Gladeville station. E. Sterrett. *Pipe Line News*, Nov. 1957, **29** (11), 35–40.—In contrast with their Mount Pleasant Station, Texas Eastern's Gladeville station employs 2 pairs of 3 compressors, piped to permit series–parallel operation. Each of the single-stage centrifugal compressors is powered by a 2500-h.p. electric motor. A diagrammatic plan of the major piping of the station is given; also details of the ventilation system and a table of operating characteristics and equipment data. D. K. R.

1382. Plantation Pipe Line adds flexibility to its system. E. Sterrett. *Pipe Line News*, Nov. 1957, **29** (11), 42–53.—Description is given of the pipelines operated by Plantation Pipe Line Co. which carry up to 94 different batches at the same time. The main flow lines are up to 18 inches dia, with 14-, 12-, and 10-inch pipes also being used. The products are divided into 2 classes on a gravity basis to help avoid contamination of batches of widely diverging characteristics. The large dia lines are used for gasolines and other fluids of similar visc, while the smaller lines transport fuel oils, diesel oils, etc. To assist in organizing the despatch of the batches, all information is teletyped to a main office in Atlanta, and despatchers are kept in touch with operators at all manually operated stations on the line by teletypes. Many stations are remotely controlled from the master stations, the operating orders being transmitted by teletype or microwave. A table of data concerning Plantation Pipe Line's system is given. D. K. R.

1383. Two-phase concurrent flow of liquids and air through inclined pipe. W. E. Brigham, E. D. Holstein, and R. L. Huntington. *Pipe Line News*, Nov. 1957, **29** (11), 57–9.—A description is given of experiments done to study the effect of up and down hill flow on pressure drop. Recent field results have shown excessive pressure drops in 2-phase pipelines in hilly country. A survey of previous work done in this field is given, with particular reference to the correlations of White and Martinelli. Plots of the results obtained are given, both as graphs of pressure drop *v.* air mass velocity and using the 2 correlations; the White correlation gives a fair fit, whereas the Martinelli correlation gives banded results rather than a curve. D. K. R.

1384. Use of the plug valve as a control valve. J. H. Stannard, Jr. *Pipe Line News*, Nov. 1957, **29** (11), 60–4.—The plug valve has been used as a control device with a rule-of-thumb approach for many years by engineers. This paper attempts to give a definite guide to their application. Information about control valves, and the use and suitability of plug valves in this capacity, is given under the following headings: control valve sizing, rangeability, leakage, plug valve flow characteristics and mechanical characteristics, precautions to be observed in the use of plug valves as control valves; operating experiences of the plug valve used as a control valve and noise control with a plug valve. The financial advantage of good design in terminal station performance is illustrated by a worked hypothetical pipeline problem. D. K. R.

1385. Operation of fluid drives in pipeline pump stations. F. A. Moore. *Pipe Line News*, Nov. 1957, **29** (11), 65–7.—The use of a variable speed fluid drive in booster stations on pipelines is discussed. The flexibility that this type of drive gives to a pump, plus the savings in power costs, are 2 of the advantages mentioned. Examples of power saving experience using fluid drives are given, together with a brief description of the operation of Ohio Oil Co.'s Rochdale station, which employs this type of equipment. D. K. R.

1386. Crossings made at two per mile rate on Tecumseh pipeline. W. Quarles. *Pipe Line News*, Nov. 1957, **29** (11), 68–70.—Description is given of the difficulties encountered during the laying of the Tecumseh Pipe Line Co.'s 20-inch crude pipeline. The main obstacles were numerous drainage ditches and some peat bogs. Submerged crossings were used in both cases, and details of the laying procedure are given. The method employed for river and under-track crossings is also mentioned. D. K. R.

1387. Atlantic expands Texas communications network with microwave. M. S. Collet. *Pipe Line News*, Nov. 1957, **29** (11), 72–6.—To allow Atlantic Pipe Line Co. to almost double its communications system to the Texas region, a 171-mile stretch of wire line is being supplemented by a microwave system. There are only 6 stations on the route, which has towers of up to 300 ft high, the largest single path being 50·1 miles long. Initially 13-voice channels will be provided, but design allows for expansion up to 46 channels. Advantages of the system are expected to be reliability and elimination of major outages due to weather and man-made damage. The system provides a cornerstone for future microwave expansion. D. K. R.

1388. Sahara pipelines. C. Deutsch. *Bull. Ass. franç. Tech. Pétrole*, 1958, 45–58.—Present 6-inch, 200-km line from Hassi Messaoud to Touggourt will be replaced by 2 × 700-km lines to coast for Edjeleh (16-inch seamless) and Hassi Messaoud (24-inch welded), scheduled for completion early in 1960. Construction materials, transport, route surveying, capacity, and pumps are discussed, and cost estimates given. W. A. M.

1389. How gas storage wells behave. Pt 2. C. J. Walker *et al. Petrol. Engr*, 1957, **29** (10), D29–31.—Withdrawal tests on gas storage wells resulted in the recognition of the type of test giving the best deliverability data. E. A. G. H.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

1390. Unprecedented refinery expansion. Anon. *Petrol. Press Serv.*, 1958, **25**, 43–6.—Average demand for petroleum products in the free world outside N. America has increased by 30–40 million metric tons p.a. Ample crude is available to meet this expansion rate, but—with existing refining plants normally utilized at over 80% capacity—refining facilities must be increased. In the past decade refinery capacity in the free world outside N. America has almost trebled, reaching 360 million tons. The vast expansion programme includes 43 projects for new refineries—combined crude oil throughput capacity *ca* 100 million tons p.a.—and 22 expansion projects which, if completed, would provide 43 million tons additional capacity. *Ca* 36 million tons of new capacity is expected to be ready during 1958. In the U.S.A. total capacity—although bigger than in the rest of the free world—has been expanding much more slowly. A figure of 9,259,200 b.d is forecast for the end of Sept. 1958. A feature of post-war refinery expansion is new capacity location, mainly in importing/consuming countries. Some new projects are under way in producing/exporting countries, *e.g.* Kuwait and Venezuela. Most new capacity is being erected in consuming/importing countries of Europe, and, to a lesser extent, of Asia and Latin America. In Europe most of the new plants will have no cracking facilities, and the average capital cost will be correspondingly low; some will have cat reformers to produce high-grade motor gasoline. Expansion in Europe will involve a capital expenditure of *ca* £650 million. Construction of new pipelines for crude transport to the refineries is discussed. R. T.

1391. Lobitos' Ellesmere Port platformer. Anon. *Petroleum, Lond.*, 1957, **20** (12), 451–2.—A small platforming unit of 600–800 b.d. capacity has been designed to upgrade 2 differing feed stocks, a light Peruvian naphtha and a wider Middle East cut. Gas produced from the process is used as a refinery fuel and the remainder sold to a town gas undertaking. A. E. R.

1392. Weaste refinery. Anon. *Petroleum, Lond.*, 1958, **21** (1), 17–18.—Details are given of a new 100,000 tons p.a., 2-stage crude dist unit with a throughput of blended crudes at Weaste refinery. A. E. R.

1393. Construction at Fawley refinery. J. L. Corlett. *Petroleum, Lond.*, 1958, **21** (1), 14–16.—Aspects of construction work at Fawley refinery are described and include relationships with trade unions, stress relief in welded steel vessels on the site, and the value of simulating equipment to avoid delays caused by late delivery from sub-contractors. A. E. R.

1394. Reconstruction of Syriam refinery. Anon. *Petroleum, Lond.*, 1957, **20** (11), 403–5.—The replanning and reconstruction of a 5000-b.d. refinery in Burma using salvaged equipment from a previous war-damaged refinery is described. Process design aims at producing the max amount of motor spirit from the crude to meet local needs. Straight-run products up to the gas oil range after blending and treatment are marketed. The waxy portion of the crude is cracked, and after acid and soda treatment and redistillation yields motor spirit and kerosines. A. E. R.

1395. The Tidewater Delaware refinery. Anon. *Petroleum, Lond.*, 1957, **20** (10), 372–6.—The tendency towards higher quality petroleum products, and site and labour costs in the U.S.A. resulted in the building of a new refinery incorporating large units for each process and combining several licensed processes into a homogeneous unit. Operational details for some units are provided. A. E. R.

1396. Automatic scanning of process variables. Anon. *Mech. World*, 1957, **137** (3461), 537.—Automatic scanning is discussed generally, and reference made in particular to its use in oil refineries. D. K.

1397. Progress in absorber and fractionator design. Anon. *Chem. Proc. Engng*, 1958, **39**, 41–7.—After brief consideration of limiting conditions of usefulness of bubble-cap trays, recently developed alternatives are surveyed, including Turbogrid, Uniflux, float valve bubble trays, Benturi, Flexitray, perforated plates, and ripple trays. Mode of operation of each is described, and comparisons are made with bubble-cap trays in respect of flexibility, eff, ease of maintenance, and initial cost. W. A. M.

1398. Alternative-fired and dual-fired steam boilers. Anon. *Mech. World*, 1957, **137** (3461), 534.—Some recent developments in this type of equipment are discussed. D. K.

1399. Testing of petroleum equipment. W. E. Schall. *Petroleum, Lond.*, 1957, **20** (10), 377–80.—Non-destructive testing techniques make possible the examination of whole petroleum plants and pipelines and are very useful for the testing of welds in equipment operating at high pressures and temp. Techniques reviewed include X-ray and ultrasonic testing. A. E. R.

1400. Two aspects of automation in refining. L. Walter. *Petroleum, Lond.*, 1957, **20** (10), 369–71.—To control some refinery processes adequately may entail an amount of detailed information reaching several hundred figures, and automation is then necessary. 2 methods of control which are electronically operated are described. Monitoring depends on the instruments gathering the information and leaving the operator free to supervise significant variables. A "scanning" system utilizes multipoint instruments so that any thermocouple may be checked at will, and a continuous record may be kept. A. E. R.

1401. Valving critical in elaborate distribution system. H. W. Boyd. *Petrol. Engr*, 1957, **29** (11), C66–8.—Attention to system planning of multiple piping circuits for moving a variety of liq assured a flexible and economic distribution system. Use of pipe segments allows any area of the plant to be connected easily to another area. Many plug valves are used at low cost and are easy to maintain, taking up little space. A. E. R.

1402. Automation in refinery product blending. Pt 2. L. Lowy. *Petrol. Engr*, 1957, **29** (11), C53–65.—Accurate control of the flow of additives to petroleum products is very necessary to avoid products not conforming to specifications and increased costs due to excess addition of costly chemicals. Various types of equipment that may be used for proper proportioning in continuous blending are described. A. E. R.

1403. Permanent wool overcoats save heat. D. P. Larer. *Petrol. Engr*, 1957, **29** (11), C38–40.—Spun mineral wool blankets were selected for the insulation of refinery equipment because of their thermal efficiency and good mechanical properties. The blankets were secured by steel bands and laths, and a layer of mineral wool finishing cement superimposed for weatherproofing. A. E. R.

1404. Crude oil desalting. L. C. Waterman and J. R. Moechel. *Petrol. Engr*, 1957, **29** (11), C21–9.—Disabling of refinery dist equipment has been caused by salt water, which is present in crude oil due to brine underlying the crude in the producing stratum. Average water and salt contents of raw American crudes received at refineries are 0·3 vol % and 170 p.p.m. respectively. Dehydration of the crude oil emulsion is accomplished by gravity settling with the addition of heating to reduce the settling time. Stable emulsions of very small particles may be coalesced by demulsifying chemicals. Emulsions may also be broken by the use of high-voltage electric fields. The salt content of incoming crudes may be reduced by dispersing fresh water in the oil and again using a dehydration process; however, efficient methods of desalting are described which use chemical or electrical equipment. Efficiencies of over 95% are reported with simple operation at nominal cost. By adjusting desalting procedures, abrasive solids, arsenic content, organic acidity, and mineral acidity in the incoming crude may be reduced. A. E. R.

1405. Process-type instruments installed on new refinery boiler. H. G. Morgan. *Petrol. Engr*, 1957, **29** (11), C17–19. —To obtain adequate control of a new refinery boiler, and to compensate for severe load changes, conventional refinery instrumentation was installed. Maintenance of the equipment is easy, and wide flexibility of operation is permissible with the minimum of personnel. A. E. R.

1406. Design of heat exchangers on automatic computers. A. M. Peiser. *Petrol. Engr*, 1957, **29** (11), C12–16.—Standard engineering design calculations are being adapted to automatic computing machinery. The analysis of stresses in piping systems, the design and rating of flanges, and the design of liq–liq heat exchangers have been computed automatically. The capacity to examine various alternatives in a given design has been greatly increased. Savings in costs result from the computer working *ca* 10 times faster than personnel. Use of the computer enabled peak work loads to be absorbed without extensive overtime working. A. E. R.

1407. How to design finned tube shell and tube heat exchangers. Pt 1. E. H. Young and D. J. Ward. *Petrol. Engr*, 1957, **29** (11), C7–11.—Fundamental heat transfer relationships for determining the required finned tube heat transfer area for shell and tube units are presented. Fouling factors on the outside of finned tubes are about the same as for bare tubes. 21 refs. A. E. R.

1408. Plated sheet metal in the petroleum industry. H. Lejay. *Rev. Inst. franç. Pétrole*, 1958, **13**, 172–6.—To combine strength and cheapness with corrosion resistance, plated steels, consisting of a thin layer of a stainless alloy plated on to a thicker non-stainless base, are used. Methods of fabrication and working of these cladded steels are discussed, and their advantages outlined. W. A. M.

1409. Problems set to the steel industry by the Lacq deposit. L. Colombier and J. Hochmann. *Rev. Inst. franç. Pétrole*, 1958, **13**, 165–71.—Lacq natural gas must be handled at high pressure and contains moisture, CO_2, and 15% H_2S. To overcome problems of pipeline embrittlement and corrosion a non-stainless steel, MOVP, containing Cr 2·5, Mo 1, V 0·5%, and a stainless steel, containing 13% Cr with additions of Mo and V, were developed. For valves, etc., a stainless steel, Uranus 50, having an austeno-ferritic structure, was developed from 18/8 by increasing the Cr and adding Mo. Details of tests for resistance to corrosion under tension are given. W. A. M.

HYDROGENATION

1410. Making butadiene. 4. Feed preparation and finishing. J. C. Reidel. *Oil Gas J.*, 16.12.57, **55** (49), 110.—Close volatilities of the C_4's make their separation difficult. Process is described employing acetone or acetonitrate extractive dist for the feed preparation, and extraction with cuprous ammonium acetate for butadiene recovery. G. A. C.

ALKYLATION

1411. Bauxite filters boost alkylate quality. V. L. Brant. *Petrol. Engr*, 1957, **29** (11), C32–5.—A bauxite treating system for the effluent of an alkylation unit proved satisfactory. Fouling and corrosion, aggravated through operating well above design capacity, were reduced, thus decreasing maintenance costs. Further cost savings resulted from lower operating costs and an increased TEL susceptibility of the alkylate. A. E. R.

CHEMICAL AND PHYSICAL REFINING

1412. Low temperature separation of hydrocarbons. C. C. King. *Petroleum, Lond.*, 1958, **21** (2), 59–60.—New trends in the liquefaction of gases are discussed, in which normal refining methods are used and refrigeration is treated as a service. General operating variables and procedures for each stage of the liquefaction are provided. Design considerations and new developments are outlined. A. E. R.

SPECIAL PROCESSES

1413. Hydrogen treating in the refinery. Pt 2. P. W. Sherwood. *Petroleum, Lond.*, 1957, **20** (10), 363–7.—Processes for upgrading virgin or cracked naphthas are described. The Shell vapour-phase process using a tungsten–nickel cat at 345° C removes sulphur while maintaining a quantitative yield of hydrocarbon. The Esso " Hydrofining " process is used for upgrading or desulphurization and saturation, and the cat life is up to a year. Desulphurization is combined with high-yield conversion of heavy residues to lighter products in the " Gulf HDS " process. A. E. R.

1414. Seven methods of removing CO_2 from high CO_2-content gas. J. F. Mullowney. *Oil Gas J.*, 10.2.58, **56** (6), 93.—A comparison is given of battery limits investment and operating costs for treating a gas stream containing *ca* 34% CO_2 down to 10–25 p.p.m. by different treating schemes. 7 different methods are discussed. G. A. C.

1415. Recent developments in petroleum chemicals. I. P. N. Collinswood, C. F. M. Mackintosh, and H. Steiner. *Petrol. Times*, 28.2.58, **62** (1580), 175.—Main developments and trends in N. America and Europe are dealt with, including some projects planned for the new producing areas.

Tables show development in the U.S.A. from 1953 to 1956, estimated production of petroleum chemicals 1955–57, and forecast of end-use pattern 1956–65. Future for propylene and derivatives, polyurethane, synthetic rubber, styrene, butadiene isoprene, and *iso*butylene reviewed. G. A. C.

1416. CO_2 removal by the hot potassium carbonate process. Anon. *Oil Gas J.*, 10.2.58, **56** (6), 98.—This new process uses a K_2CO_3 soln of 20–45% concn and absorbs 3–7 cu. ft. of CO_2 per gal of soln. The process reduces plant investment and conserves energy. Carbon steels are used in the plant except for stainless steel trim on components such as perforated trays. A table shows comparative costs of treating with K_2CO_3, monoethanolamine, and water. G. A. C.

1417. Shell gasification process. Anon. *Chem. Proc. Engng*, 1958, **39**, 61.—Process involves continuous non-cat partial oxidn of liq or gaseous hydrocarbons to produce synthesis or town gas high in H_2 and CO. Heat evolved is used to raise steam for process and other uses, and a wide range of feedstocks can be gasified. Schematic flow diagram is given. W. A. M.

1418. New lanolin fraction for wax dispersions. D. Schoenholz and G. D. Burns. *Soap, N.Y.*, Jan. 1958, **34** (1), 92.—A hard waxy lanolin derivative rich in sterol esters can be used to partially replace amine soaps used to disperse waxes in manufacture of floor polishes. Also theoretically possible for greater freedom for blending alkali soluble resins and other extenders to form stable products. G. A. C.

METERING AND CONTROL

1419. Electric control-valve operators. G. F. Brockett. *Insts & Automation*, 1958, **31** (1), 111–16.—This article gives a detailed description of the available and experimental electric-powered control-valve operators. It also presents an investigation of the inherent problems, describes various solutions, analyses the economic factors, and outlines the expected improvements in future development. M. J. R.

1420. Metering gas with a heated thermopile. R. T. Doyle. *Insts & Automation*, 1957, **30** (12), 2276–8.—The heated thermopile principle has found wide application in the measurement of velocity, mass flow, pressure, and vacuum. However, its development for metering gas has been slower than in the other 2 fields, because of the fear that the heated elements might lead to explosions. This fear is now being removed, as instruments have been designed to operate with temp rises less than the ambient temp difference normally incurred between summer and winter. As the instrument is also almost perfectly indicative of mass flow, it is now being used to meter explosive mixtures, such as hydrocarbon gases in refineries. M. J. R.

1421. Automation in the chemical industry. (In German.) O. Winkler. *Chem. Ing. Tech.*, 1958, **30**, 1–7.—A review and critical appraisal of present trends in the automatic control of chemical plant. P. J. K.

PRODUCTS

CHEMISTRY AND PHYSICS

1422. Temperature *v.* heat of vaporization. W. R. Gambill. *Chem. Engng*, 1958, **65** (1), 159–62.—Several methods of dealing with the variation of latent heat with temp are discussed, and data are given for some hydrocarbons. Several refs. P. J. O.

1423. Some features of the metal salt initiated reaction of liquid phase hydrocarbon oxidation. I. B. G. Freidin. *Zhur. Priklad. Khim.*, 1957, **30**, 768–74.—Oxidn of 220°–330° C cut of synthetic fuel (*ca* 80% *n*-paraffins, 20% *iso* cpds). Mn or Cr naphthenate cat, 120° C, air blowing. Induction period longer with Mn than Cr, and lengthens with increasing concn of former. Alcohol addition accelerates transfer of metal cat to higher valency state, as indicated by colour change. Metal cpds of such higher valency state are probably of complex structure (view confirmed by absorption spectrum comparisons at 4000–7000 Å); formulæ therefor are suggested. V. B.

1424. Oxidation mechanism of simple hydrocarbons. N. N. Semenov. *Chim. et Industr.*, 1958, **79**, 3–10.—Russian work on photochemical oxidn of CH_4, C_2H_6, and C_3H_8 showed that at 120° C primary products were hydroperoxides, followed later by secondary products (CO, CO_2, etc.). As temp was raised, aldehydes appeared as primary products and finally predominated; use of tracers showed that they were formed by isomerization of hydroperoxides. With C_2H_6 and higher hydrocarbons there are 2 different ways of isomerization, giving rise to several reaction chains and a large number of intermediate products. Thermal oxidn can take place without activation energy by formation of active centres on container walls. Effects of aldehydes, N oxides, O_2, and ionizing radiation on induction period were studied. 26 refs. W. A. M.

1425. Ion exchange. Y. L. Gladel. *Rev. Inst. franç. Pétrole*, 1957, **12**, 936–43; 1958, **13**, 177–93.—An introduction to the subject, comprising nature, structure, and synthesis of ion exchangers, theory, mechanism and methods of ion exchange, and applications. 45 refs. W. A. M.

1426. Kinetic study of the combustion of cyanogen. H. James. *Rev. Inst. franç. Pétrole*, 1957, **12**, 1241–93; 1958, **13**, 83–113.—Combustion of C_2N_2 in air and O_2 was studied at sub-atm pressures by a static method. Kinetics of the reactions were established and effects of physical factors, *e.g.* presence of inert gases, nature and size of combustion chamber, were investigated. 78 refs. W. A. M.

1427. The point of attack in the oxidation of hydrocarbons. C. F. Cullis. *Petroleum, Lond.*, 1958, **21** (2), 49–52.—When selective oxidn occurs, certain parts of an organic mol may be attacked while others remain unaffected. Theory indicates that attack should occur preferentially at a tertiary carbon atom, but most experimental evidence suggests that oxidn occurs mainly at secondary carbon atoms, at which, although initially not so rapid as for a tertiary carbon atom, the effect of chain reactions produces a rapidly increasing rate of oxidn. Detection of oxidn attack may be achieved directly by the use of isotopic carbon or deuterium cpds. 51 refs. A. E. R.

ANALYSIS AND TESTING

1428. Semi-micro gravimetric determination of sulphur in organic compounds by combustion. A. Etienne and J. Léger. *Chim. anal.*, 1958, **40**, 43–6.—S in org cpds can be determined by combustion of 10–15 mg in O_2 (40 cc/min) in an empty quartz tube, 60 cm long, 15 mm ext dia, at 700°–750° C, the exit gases being passed over tared Ag gauze, surrounded by Pt gauze, at 550° C. The SO_3 is converted to $AgSO_4$, which is determined by re-weighing the gauze (to 0·01 mg). If

halogens are present, wt of $AgSO_4$ is obtained by water-washing the Ag gauze. Time required for combustion is 15 minutes, cooling 5 minutes. Precision is $\pm 0{\cdot}1\%$. Limits of re-use of Ag and method of regeneration are given. Method can be applied to light and heavy fuel oils. W. A. M.

1429. Nomogram; how to estimate solubility of water in hydrocarbons. D. S. Davis. *Chem. Proc. Engng*, 1958, **39**, 99.—Solubility in mol % (0·01–10) of water in a hydrocarbon can be estimated at any temp (50°–400° F) with fair accuracy if solubility at one temp is known. W. A. M.

1430. Graphical determination of aromatic carbon and naphthenic carbon in mineral oil fractions. J. Cornelissen and H. I. Waterman. *Chim. et Industr.*, 1958, **79**, 26–9.—Graphs of log v against $n-0{\cdot}35d$ (for % C_A) and $n-\frac{1}{2}d$ (for % C_N), all at 20° C, are presented. Earlier methods for determining structure are summarized. W. A. M.

GAS

1431. Liquefied natural gas. Pt II. C. I. Kelly. *Petrol. Times*, 14.2.58, **62** (1579), 120.—This part concerns the practical development of liquefaction, storage, and regasification of the liq, and also deals with the explosion at Cleveland in Oct. 1944, and gives the U.S. Bureau of Mines conclusion on the explosion and conflagration. G. A. C.

1432. The reforming of refinery gases. Anon. *Petrol. Times*, 14.2.58, **62** (1579), 127.—A description is given of the scheme at Romford Gas Works of the North Thames Gas Board for reforming refinery gases from Shell Haven to produce 36 million cu. ft/day of 500 B.t.u. gas with burning characteristics of conventional town gas. G. A. C.

1433. Technical development of the oil cracking process for producing town and industrial gases. (In German.) M. Gerhold. *Erdöl u. Kohle*, 1956, **9**, 765–70, 844–51.—Pt 1. Technical foundations: production of ethylene and olefin-rich gases. Pt 2. Production of town gas and synthesis gas from liq and gaseous hydrocarbons. Pt 1. Use of petroleum products—to cover the energy gap in Europe—for town gas manufacture is discussed. Types of reactions used to convert hydrocarbon oils into gas possessing desirable characteristics, and their applications, are presented with supporting plant illustrations of sp processes. Procedure for cracking and reforming hydrocarbons depends upon the desired final product composition, and chem properties of the charged materials. Sp procedure for producing ethylene and olefin-rich gases is discussed. In the gas industry intensified use of oil cracked gas is expected. In the process for town gas production from petroleum products the primary reaction consists of cracking high-mol hydrocarbons at the C–C bond. The *sec* reaction is a partial cracking of the primary cracked fragments to CO and H_2. Ethylene, propylene, and hydrogen are valuable products for industrial syntheses. 13 refs.

Pt 2. Production of fuel gas similar in composition to town gas is discussed. Reaction mechanisms of the various cracking processes—applicable to a large scale of hydrocarbons—for producing town gas are presented, with schematic diagrams, and relevant theoretical and practical considerations. For synthesis gas production the complete gasification process and use of fluidized cat are the most promising. Studies of the reaction mechanism of liq hydrocarbon conversion show that essential improvements in gas composition and process control are obtained by separating the reaction phases, and activating the main reaction with oxidic or bifunctional cat. Tech development indicates that the menacing energy gap in the world can be bridged over until the age of atomic power, and requirements of basic materials for chem industries are satisfied adequately. 32 refs. R. T.

ENGINE FUELS

1434. Choice and evaluation of gum-inhibitors and metallic deactivators for power fuels. (In German.) E. G. Nottes. *Erdöl u. Kohle*, 1956, **9**, 853–7.—Incidence of gum formation in gasolines on storage—even in products from the most modern cat processes—is explained. Selection of a suitable inhibitor—presumed to effect peroxide formation prevention by a chain reaction—is not arbitrary. Relevant factors are gasoline composition, type and quantity of S compounds, etc., also the necessity for adding metal deactivators, and subsequent tinting of the finished gasoline. Conventional gum inhibitors fall into 3 classes: derivatives of aminophenols, N-substituted phenylenediamines, and poly-alkylated phenols. Applications of sp representatives of these classes and possible effects on sweetening and O.N. are discussed. Metal traces, *e.g.* Cu are removed—as discussed—by adding salicylaldehyde derivatives with gum inhibitors. R. T.

GAS OIL AND FUEL OIL

1435. Modern town-gas production. (In German.) F. Schuster. *Chem. Ing. Tech.*, 1958, **30**, 61–6.—Town gas is normally produced from coal by the classical processes, but there are problems of raw material supply, elasticity, and the sale of by-products (especially coke). Production of town gas from other sources, including liq and gaseous hydrocarbons, is possible, and the techniques are discussed in detail. Although, in coal-producing countries, the classical methods will remain the basis of production, the use of hydrocarbon sources can add much flexibility. P. J. K.

1436. The treatment of residual fuel. D. W. Crancher. *Petrol. Times*, 14.12.58, **62** (1579), 136.—An extract as an appendix to a paper entitled "Materials for Superheater Tubes and Supports," by D. W. Crancher before the Institute of Marine Engineers, Jan. 1958, and deals with 2 methods of treating residual fuel to prevent ash fouling and corrosion. G. A. C.

LUBRICANTS

1437. Lubricants under radiation. Anon. *Mech. World*, 1957, **137** (3461), 551.—Very brief note of the work of the Wakefield group in this field. α and β particles are generally harmless to lubricants, as they are absorbed by the structure and shielding of the pile; γ Radiation and neutrons can have the effect of thickening lubricants till they are unserviceable. Certain types of petroleum-based lubricants have shown greater resistance to the thickening effect than others, and some materials not of petroleum origin show considerable promise. D. K.

1438. Blended oils. Anon. *Mech. World*, 1957, **137** (3461), 544.—Determination of the visc of a blended mixture of 2 oils, or the percentage to be added of an oil with a higher or lower visc to achieve a desired bulk visc, can be done by relating visc in conventional units to an arbitrary scale known as the Stoney No. Tables and a graph are included from which conversions may be made. Calculations and conversions are only valid for the same temp. D. K.

1439. Metal cutting research and drilling technique. Anon. *Mech. World*, 1957, **137** (3461), 539.—The methods and results of research carried out by the Production Engineering Research Association are described. Particularly considered is the work done on drills and drilling machines. D. K.

BITUMEN, ASPHALT, AND TAR

1440. Bituminous-based protective coatings. W. Murray. *Petroleum, Lond.*, 1957, **20** (10), 384.—The development of coloured bituminous-based coatings retaining the desirable properties of bitumen is recorded. A. E. R.

SPECIAL HYDROCARBON PRODUCTS

1441. Construction and operation of test floor for waxes. D. Schoenholz and G. D. Burns. *Soap, N.Y.*, Oct. 1957, **33** (10), 82.—The purpose of the test floor is to evaluate the durability of the floor wax film and slip resistance. The test procedure comparatively rates performance properties of the wax before, during, and after traffic. The construction of the floor is described in detail. Maintenance of test floors, evaluation of performance, evaluation of results, and scoring are discussed. D. K.

DERIVED CHEMICAL PRODUCTS

1442. Britain's petrochemical industry. Anon. *Petroleum, Lond.*, 1958, **21** (2), 41–4.—Recent plans and developments in the expansion of the petroleum chemical industry in Britain include a large-scale synthetic phenol plant and a low pressure polythene plant at Grangemouth, a fourth "alkathene" plant and other extensions at Wilton, the direct cat oxidn of ethylene to ethylene oxide at Partington, and an ammonia and fertilizer plant at Shell Haven. A. E. R.

1443. British petrochemical developments. T. H. H. Skeet. *Chem. Proc. Engng*, 1958, **39**, 87–90.—Recent developments in the British petroleum chemical industry are briefly surveyed. Diagrams show the pattern of processing in 3 big U.K. groups, and production data for the main thermoplastics are tabulated. W. A. M.

1444. Chemicals, plastics, and rubber from petroleum at Fawley. J. A. L. Spiers, K. C. Bryant, and K. G. Burridge. *Chem. Proc. Engng*, 1958, **39**, 91–2.—Summary of the symposium held by IP, Plastics Institute, and Institution of the Rubber Industry. Main chemicals to be produced at Fawley will be C_2H_4, butenes, and butadiene, by steam coil cracking and Esso dehydrogenation process. Plastics production will include PVC and polythene (high pressure process). Synthetic GR–S rubber will be made by copolymerization of butadiene and styrene. W. A. M.

1445. Solvents from petroleum. F. E. Hixon. *Petroleum, Lond.*, 1957, **20** (12), 448–50.—Propylene obtained from refinery waste gases may be used as the starting point for several solvents, the most important being acetone. *iso*Propanol may be formed from propylene by a liq phase process using sulphuric acid or by direct hydration, and the alcohol is converted to acetone by cat dehydrogenation. Acetone may also be prepared by alkylating benzene with propylene, treating the cumene formed with sodium hydroxide and then sulphuric acid, forming phenol as a by-product. Flow diagrams and operating details for these processes are provided. A. E. R.

1446. Hydrogen peroxide—petrochemical newcomer. Pt 2. P. W. Sherwood. *Petrol. Engr*, 1957, **29** (11), C42–50.—Hydrogen peroxide (HP) may be formed by direct oxidn of hydrocarbons. Conditions are adjusted for max formation of HP and removal of the combustion products from the reaction zone, to minimize the effect of the HP decomposition reaction. HP may also be formed by oxidn of aliphatic alcohols in the liq phase. Dilute HP soln are purified by ion exchange or other chemical methods and concentrated by fractional dist. 24 refs. A. E. R.

1447. Ammonia synthesis gas from petroleum refinery vent gas. M. R. Jester. *Fluid Handl.*, 1958, 43–5.—Abstract of paper given to Inst. Chem. Engrs and Phys. Soc. NH_3 synthesis gas is made from refinery vent gas by removal of CO_2 and H_2S by caustic washing, H_2O by desiccant, C_2 and higher hydrocarbons by refrigeration, and CO and CH_4 by scrubbing with liq N_2 (from air separation plant). The N_2/H_2 mixture from the scrubber is adjusted to correct proportions by adding N_2. W. A. M.

1448. Prospects of sulphur production in France. J. Fouchier. *Chim. et Industr.*, 1958, **79**, 225–9.—S recovery from refinery gases (25,000 tons p.a.) is now over-shadowed by use of Lacq natural gas (H_2S 15·3%), which is ethanolamine-washed with subsequent recovery of S by Claus process (flow sheets). Plant erected in 1957 processes 10^6 m^3 gas/day, with annual S production of 60,000 tons p.a., 20-fold increase is planned by mid-1961. V. B.

1449. Problem of sulphur and its recovery from sulphur-bearing materials. G. Pannetier. *Chim. et Industr.*, 1958, **79**, 150–9.—Main attention devoted to S recovery from H_2S. Wet (*e.g.* ethanolamine) and older dry (*e.g.* iron oxide) processes for removal of H_2S from gas streams are discussed, followed by more detailed consideration of recent patent literature of cat oxidn processes, including H_2S/SO_2 reaction. V. B.

1450. Isotactic propylene here. F. Arne. *Chem. Engng*, 1958, **65** (1), 92.—A new polypropylene, produced in Italy, is said to be very light in weight and unusually heat-resistant for a thermoplastic. The reason for its superior properties lies in the structure of the macromolecule, carefully controlled in the polymerization process. Probable uses include hot water pipe, moulded applications, and fibres. The material is expected to compete in price with polyethylene. P. J. O.

1451. Men, molecules, and medicines. D. G. Cooley. *API Quart.*, Winter 1958, 30–4.—A review of the vital roles played by petroleum chemicals. R. T.

COAL, SHALE, AND PEAT

1452. Coal extraction. (In German.) C. Kröger. *Erdöl u. Kohle*, 1956, **9**, 839–43.—Pt. 4. Behaviour of banded types and structural constituents (Macerates). The chief difference in banded coal types is of a purely physical nature. Pts 1, 2, and 3 dealt with extraction behaviour of normal coals, *i.e.* conventional banded coals. They did not deal with petrographic differentiation of the coals according to band types or structural constituents. In Pt 4 this work is reviewed, and some investigations are reported on sp tests on structural constituents separated from Ruhr seam coals with various solvents. In the residual coals of the present carbonization range a rising coking capability remains with increasing carbonization. Small extractability and bad coke formation, with low carbonization, is characteristic of vitrinite. It is easily understood that—in coking dull coal and dull coal residues—very variable results must appear, according to the ht of the exinite cont and its carbonization stage. R. T.

1453. The future of oil shales. Anon. *Petroleum, Lond.*, 1957, **20** (12), 443–5.—Reserves of shale oil in the U.S.A. are very large; however, the problems of extracting the oil from the rock and its transportation do not yet allow economic operation. 2 retorting processes working on a pilot-plant scale are described. Raw shale oil from Colorado shale is very viscous due to a high wax content. It must be "coked" to remove wax and then hydrogenated at high temp and pressures to remove nitrogen and sulphur. The crude is a high-grade light oil. Shale oil is suggested as the solution to California's growing demands provided a pipeline could be erected from Colorado. A. E. R.

1454. Recent developments in oil shale. A. Matzick and R. J. Cameron. *World Petrol.*, 1957, **28** (10), 68.—Among recent developments in oil shale operations in the U.S.A. is the investigation of underground combustion methods, or *in situ* retorting. Field tests have been made near Grand Valley, Colorado, in which gas-injection and oil-producing wells are drilled into the shale. After establishing permeability by fluid injection under high pressure, the formation is ignited at an injection well and an advancing thermal wave heats the shale to retorting temp and drives the oil vapours to the producing wells. The method has many advantages over conventional processing, due mainly to the elimination of mining and crushing of the shale.

Other developments in the oil shale industry include a project, also in Colorado, to determine the economics of a commercial oil-shale venture, and the Aspeco process, in which a new method of retorting is being developed involving 2 horizontal rotating kilns.

Details of the oil shale resources of NW. Colorado have recently been published, and total reserves of an area of *ca* 1400 sq. miles in part of the Piceance Creek basin are calc at a total of 7·5 billion brl using an average assay of 45 gal/ton. Potential processes could, however, handle a shale with a much lower assay value. C. A. F.

1455. Lothian oil shale field. J. T. Greensmith. *Petroleum, Lond.*, 1957, **20** (12), 439–42.—The main centres of the oil shale activity at present are part of a belt extending S. from the Firth of Forth. Production of shale oil has steadily decreased due to economic and geological factors. The oil shale group of sediments when traced away from the Lothians loses its potentiality as an oil producer. Folding and faulting of the rocks has increased the difficulties of mining; however, as a result of these disturbances, and subsequent erosion, the beds are exposed for economic working at or near the surface. Variations in lithological position of the oil shale seams makes the discovery and tracing of new underground seams more difficult. A. E. R.

MISCELLANEOUS PRODUCTS

1456. Petroleum coke becomes finished product. L. E. Adee. *Oil Gas J.*, 10.2.58, **56** (6), 115.—Continental Oil Co. is now producing 85,000 tons p.a. of calcined coke at its Lake Charles, Louisiana, refinery for industrial use to customer specifications. The product is held in 4 silos, precautions being taken to keep it dry; finally, it is delivered in covered hopper cars. G. A. C.

1457. Thioether non-ionic surfactants. J. L. Eaton and W. G. Kayser, Jr. *Soap, N.Y.*, Oct. 1957, **33** (10), 49.—Derivation properties and uses of the thioether type non-ionics are discussed. Certain limitations on their use as well as potential advantages (due to the reactivity of the sulphur atom) have been considered. In non-oxidizing neutral and alkaline media appropriate members of the series can provide high level performance in any of the fields of surface activity. D. K.

1458. Alkylphenol–ethylene oxide non-ionic surfactants. J. M. Cloney and R. L. Mayhew. *Soap, N.Y.*, Aug. 1957, **33** (8), 52.—Aspects considered are: alkylphenol preparation, production economics, basic advantages, applications, and weight advantages. D. K.

1459. Isolation and determination by ion exchange technique of non-ionic surfactants. L. E. Weeks, M. E. Ginn, and C. E. Baker. *Soap, N.Y.*, Aug. 1957, **33** (8), 47.—The non-ionic portion of a surfactant mixture can be determined gravimetrically following sorption of ionic surfactants from an aq ethanol soln on anion and cation exchange resins. Accuracy and reproducibility are satisfactory, and the method can be used for routine analysis. D. K.

1460. Transformer core temperatures. H. E. Green. *Elect. Times*, 1958, **133**, 399–402. Table giving thermal properties of transformer oil (thermal conductivity, Prandtl No., convection modulus) over range 0°–80° C is included. V. B.

CORROSION

1461. Protection of plant and equipment in the petroleum and chemical industries. H. B. Footner. *Petroleum, Lond.*, 1957, **20** (11), 422.—A lengthy abstract is presented of a paper read at the Corrosion Convention organized by the journal *Corrosion Technology* on 15–16 Oct. 1957. A. E. R.

1462. Catalyst corrosion in cat crackers. Anon. *Oil Gas J.*, 13.1.58, **56** (2), 81.—11 case histories, including problem and solution, are discussed in the control of corrosion. Regular maintenance personnel can make equipment modifications necessary. G. A. C.

1463. Corrosion damage detection. F. M. Savage. *Petroleum, Lond.*, 1958, **21** (2), 53–4.—Corrosion of refinery plant may be conveniently detected by the use of ultrasonic gauging, which indicates wall thicknesses on contact with the exterior of the equipment. Laminations or blowholes are detected, since the metal thickness down to the flaw only is measured. Accuracy of up to 1% error may be reached on normal work. A. E. R.

1464. Corrosion control, reconditioning of a bare 12-inch pipeline. C. L. Goodwin. *Pipe Line News*, Nov. 1957, **29** (11), 83–8.—This paper reports how a corrosion survey was carried out on 57 miles of 12-inch bare pipeline between Portland, Maine, and Montreal, Quebec. The pipe was later uncovered and reconditioned by repair or replacement of badly corroded sections. Protective coatings were then applied and the pipeline relaid. Details of the corrosion survey equipment and procedure are given, together with a description of the reconditioning techniques. Also mentioned is the cathodic protection scheme which had been installed for the pipeline after the survey as a temporary measure, and correlation of actual conditions with corrosion survey data. D. K. R.

1465. High-temperature sulphide corrosion. B. W. Neumaier and C. M. Schillmöller. *Petroleum, Lond.*, 1957, **20** (10), 385–6.—A shortened version is given of a paper presented to the API Division of Refining, 14 May 1956. A. E. R.

1466. Corrosion control in tankers. A. Logan. *Petrol. Times*, 28.2.58, **62** (1580), 186.—A summary is given of the paper presented by A. Logan before Inst. Marine Engrs, London, Feb. 1958. The author is a technical director of Shell Tankers Ltd and estimates that if no preventive measures were taken, corrosion with a fleet of 200 ocean-going vessels totalling 3½ million dw tons would be £2 million.

Recommendations are given for treatment of tankers in the various services, and a table shows approx costs of cathodic protection and painting of tank interiors. G. A. C.

SAFETY PRECAUTIONS

1467. A pro and con discussion of safety incentive programmes. W. R. Harrington and J. P. Carpenter. *Petrol. Engr*, 1957, **29** (11), B30–7.—The employment of incentive programmes by drilling contractors to promote safety on rigs is discussed. Many contractors have had satisfactory results, but others have experienced reverses. A. E. R.

1468. Safety in the chemical industry: safety in plant operation and maintenance (petroleum). D. A. Yonge. *Chem. & Ind.*, 1958, 272–5.—Hazards encountered in the petroleum industry due to inflammability and toxicity of petroleum products and of solvents and chemicals used for treatment, together with necessary precautions, are described. Importance of correct maintenance is stressed, and methods of testing the atm briefly surveyed. Main topics mentioned in discussion of the paper are dermatological risks of higher aromatics, so-called spark-proof tools, and underground tanks. W. A. M.

1469. Calculate adequate rupture disk size. J. G. Lowenstein. *Chem. Engng*, 1958, **65** (1), 157–8.—A new method of calculating the necessary vent capacity to deal with explosions of various materials, *e.g.* acetylene, benzene, etc., in air, is given. The graph given enables max pressure reached during an explosion to be read, also rate of pressure rise and time to reach max pressure. P. J. O.

1470. Air-pollution control. D. H. Stormont. *Oil Gas J.*, 17.2.58, **56** (7), 87.—As a result of a survey, cost of pollution control, organization for control, what researchers are doing, and trends in legislation are dealt with. In the past 2 years $46 million have been spent on control, and with an estimated 1958 expenditure of over $20 million, *ca* another $1 million will be spent on research. Controlling sulphur cpds accounts for ⅓ of expenditure. Tables show cost of air-pollution control, pollutant controlled in 5 districts, sources of air pollution, and control method and expenditure on control equipment. Among research projects are included studies of reactions of hydrocarbons, plant damage caused by air pollution, and effects of meteorological conditions. Trends in legislation are discussed and outlook of major refiners reviewed. G. A. C.

MISCELLANEOUS

1471. Pemex: the state takes over. D. Hartwell. *API Quart.*, Winter 1958, 15–18.—The Mexican oil industry, taken over in 1938, is suffering from malnutrition under nationalization. When Pemex took over the development the oil industry was in poor condition; the record since then gives rise to widely differing opinions. Under Pemex's director Bermudez progress has been made. Pipelines have been laid, refineries built, and surplus natural gas distributed. In 1956 the nation's first cat-cracking refinery was put on stream. More recently the first export of natural gas to the U.S.A. was started. The average retail price of gasoline in Mexico is 16·65 c/gal compared with 22·40 in the U.S.A., without taxes. Because Mexico lacks sufficient refinery capacity, kerosine must be purchased in the U.S.A. at 16·4 c/gal, tank-wagon price. Pemex must resell to the public at the government-fixed price of 4·5 c/gal retail. Incidentals, handling, etc., must be added. Financing of these subsidies has retarded Pemex's growth. Still, the country is prosperous. Notable accomplishments have been the discovery of 86 new fields since expropriation, 57 since 1952. Of the 1400 wells drilled 65% have been producers. In this period *ca* ¼ of Mexico's 4000 miles of oil and gas pipelines have been laid, and increase in reserves has been 300% > total production. When the Salamanca lub oil plant was opened in 1955, Bermudez persuaded U.S. companies to buy his oil and to use their own additives, enabling his distributors to enjoy the profit. With petroleum the source of 85% of the mechanical energy produced in Mexico the whole country must be geared to petroleum resources development. R. T.

1472. France's hard-won successes. Anon. *Petrol. Press Serv.*, 1958, **25**, 48–51.—The arrival of the first modest consignment of Saharan oil at the Algerian port of Philippeville symbolizes the remarkable economic progress made in recent years in France—in spite of ext difficulties and political instability—with generous U.S. aid. In spite of record production, France has been living beyond its means. Heavy subsidizing or protecting of some of its production is uneconomical. Industrial expansion has increased the dependence on imported raw materials and, therefore, need for bigger exports. However, the export potential has been reduced by various other claims on the country's resources. Resulting from the rapid growth of industrial production, energy consumption has risen by more than 60% since the war, and a further rise of *ca* 20% is expected officially by 1961. France benefits from participation in the Iraq Petroleum group and in operations of the Consortium in Persia. One method for saving foreign exchange is to have adequate refining capacity and to import only crude oil. A second method is to pay U.S. suppliers in blocked francs. The most important method for reducing foreign exchange is intensified search for oil within the French Union and in the home territory. The small investor has been encouraged to invest in oil finance companies by interest-rate guarantees. The French Government has issued successfully negotiable certificates against part of its holdings in the CFP. R. T.

1473. Spain struggles forward. Anon. *Petrol. Press Serv.*, 1958, **25**, 56–8.—Helped and sustained during the past 4½ years by *ca* $500 million of economic and military aid from the U.S.A., Spain is expanding its industrial production gradually. This production is estimated at *ca* ¼ higher last year than in 1953. In this period petroleum product consumption virtually doubled, reaching over 3·7 million tons in 1957, and is expected to reach 5½ million tons by 1960. A pipeline network has been constructed across Spain to supply U.S. air bases. Throughput capacity at Escombreras refinery —52% INS state entity and 24% Caltex and CEPSA—was raised recently to 3·5 million tons p.a. and is to be raised to *ca* 4 million tons by 1959. Spain already has a high degree of self-sufficiency in refining capacity, which will ease her foreign exchange problem. CEPSA's Tenerife refinery has a throughput of *ca* 3 million tons p.a. An INS concern proposes to build a 1,259,000-ton refinery at Puertollano to treat imported crude oil. Major recent increases in oil consumption have been in respect of fuel oil and further substantial rises in demand are expected. Consumption of gas/diesel oils has doubled and gasoline consumption has increased 28% in 4 years. Drilling is being carried out in 8 provinces with little success. Attention is being paid to possibilities of the colony of Rio de Oro, Spanish Sahara. The Government is inclined now to take a broader and more realistic attitude towards risk capital from abroad, and a new draft petroleum law is being studied. R. T.

1474. Strength of welds in carbon steel. Anon. *Petroleum, Lond.*, 1958, **21** (2), 55–8.—Short-time tensile and creep-rupture tests on standard size steel specimens were carried out to investigate weakness in welded joints of silicon-killed carbon steel plates, when a static stress was applied transversely to the joint. Weld metal flaws may determine the location of the fracture, depending on the magnitude of the flaw and the strength ratio of the weld metal and the base metal. A. E. R.

1475. Steels for the petroleum industry. F. A. Kirk and J. Williams. *Petroleum, Lond.*, 1958 **21** (1), 19–24.—A detailed comparison is made of the corrosion and heat-resisting steels specified in Great Britain and the U.S.A. for use in the petroleum industry. A. E. R.

1476. Fertilizer for rock blasting. C. J. Krapp. *Petrol. Engr*, 1957, **29** (11), D92–4.—Ammonium nitrate combined with 10% by wt of fuel oil and a small amount of dynamite has reduced the cost of rock blasting markedly in mining and construction work. The explosive is as powerful as those normally used, and handling is safe and easy. A. E. R.

1477. The " crisis " in American science. A. Eyres. *API Quart.*, Winter 1958, 3–6.—It is stated that nearly all the things of fundamental importance to U.S. industry were conceived by non-Americans. The U.S.A. is unexcelled in the capacity to develop ideas conceived. Amenities of life rather than basic necessities are emphasized in development. The petroleum industry is conspicuous among the interests which cater for basic needs. It might well take the lead in working toward the improvement of all American science. The problem of discovery, encouragement, and utilization of young inventors is the crucial one to be solved in economic and military competition with Russia. R. T.

1478. Uskmouth incident. Anon. *Elect. Times*, 1958, **133**, 508–10.—Summary of paper (A. L. G. Lindley and F. H. Brown) to Inst. Mech. Engrs covering investigation into explosion of 60 MW turbo-generator in Jan. 1956. Cause was contamination of oil in governor system by brackish water, leading to formation of corrosion cells in oil piping. Small particles of magnetite were formed, causing failure of oil-activated governor and emergency protective systems, so that machine ran up to overspeed. V. B.

BOOK REVIEWS

Electrostatics in the Petroleum Industry. A. Klinkenberg and J. L. van der Minne. Amsterdam: Elsevier Publishing Co.; London: Cleaver-Hume Press Ltd. Pp. 191. 40*s*.

The hazard arising from the accumulation of static electricity charges during normal operation in the petroleum industry has long been recognized. Fires and explosions ascribed to this cause have initiated considerable investigation and research, and have led to the adoption of generally accepted safety measures. Introduction of jet fuels has emphasized the hazard, accentuating the need for adequate precautions, but the imperfect knowledge of the mechanism of charge generation and the influence of the many contributing factors has left some doubt as to the effectiveness of the precautions presently adopted and, conversely, the justification for the increased capital and operating costs which they inevitably involve.

A fresh approach to the problem, which forms the subject of this book, is the use of an additive in the product, which, by increasing its electrical conductivity, prevents the accumulation of charge beyond safe limits. It is claimed that the use of this additive will obviate such precautions as reduced pumping speeds, floating plastic blankets in existing cone roof tanks, or gas blanketing of the vapour space even when water or contaminats known to produce peak conditions for charge generation are present, or during processes such as filtering or blending when charge generation is most likely. Very small quantities of the additive are claimed to give effective safeguards, with no detrimental effects on specification, and to remain effective through all stages to final distribution.

The wide scope of the book covers a general survey of static electricity, the principal findings of the research and development work, the basic concepts, details of system of units used in calculations, the formulæ used to evaluate field strength, relaxation time, etc., on which the degree of hazard is assessed, and a description of the instruments developed and used in field experiments with comprehensive data in tables and graphs on the values obtained.

During the large-scale tests which are described, very high values of field strength were observed without explosion occurring. By deliberately creating a spark gap in the vapour space of the receiving tank, explosions were initiated and repeated, but the subsequent repetition of the same conditions with the additive in the product gave no explosion and very reduced field strength readings.

Research continues but, meanwhile, a valuable addition to knowledge of the subject has been made. G. S. A.

The Spectroscopy of Flames. A. G. Gaydon, F.R.S. London: Chapman & Hall, 1957. Pp. ix + 279. 50*s*.

This is an authoritative text, being based largely on the experimental work done at Imperial College by Dr Gaydon and his colleagues. Although it is aimed at replacing the author's previous monograph " Spectroscopy and Combustion Theory," published in 1948, it is not a revision of the older publication but constitutes a completely new effort. Special emphasis has been given to the notable developments of the last ten years and to new experimental techniques for controlling flames and for exciting flame type spectra in special sources, such as atomic flames, flash photolysis, and shock tube excitation.

Various flames supported by air or oxygen, including explosion, engine, and industrial flames are discussed, and so too are flames supported by halogens and by oxides of nitrogen. In the chapter on " Flame Structure and Reaction Processes " the author deals with the interpretation of flame spectra in relation to the theories of chemical reaction processes in flames.

Although the book is mainly concerned with the visible and ultra-violet spectra of flames, there is a short chapter on the infra-red region. Also included is an introduction to the general theory of spectra, particularly molecular spectra, for the benefit of the reader unacquainted with spectroscopy theory. In the final chapter the author discusses the application of present knowledge of flame structure and excitation conditions in flames to analytical flame spectrophotometry.

The book is well illustrated with excellent reproductions of spectra, while an appendix gives details of wavelengths and other data useful for the recognition of spectra frequently encountered in combustion work. In addition, there is a bibliography of 464 references.

The author has endeavoured to present the subject in such a way that the book may be of service to those engaged on research in this field and yet be read easily by the

beginner or non-specialist. The book will undoubtedly be of considerable value to the research worker, but it is felt that the non-specialist may experience some difficulty with certain sections.

Nevertheless, this book can be highly recommended to all interested in combustion studies. H. P.

Studies in Early Petroleum History. R. J. Forbes. Leiden: E. J. Brill, 1958. Pp. ix + 199. 25 guilders.

As the title indicates, this volume includes a series of studies on diverse aspects of the early history of petroleum in Europe, the Middle and Far Eastern countries, and America. Some of the studies deal with early oilfields, such as those of Gabian in Southern France, in Hanover at Tegernsee, and Modena, Italy, many of which were known in the Middle Ages. An account is given of early speculations on the nature and origin of petroleum from those of Agricola in his *De Re Metallica*; several of the studies deal with the medical virtues of crude petroleum. A Dutch reference to the use of oil in troubled water at sea dates back to 1775, although Pliny in A.D. 75 anticipated this in his statement that " all sea water is made smooth by oil."

The use of wood and coal tar as a source of materials for the chemical industry is discussed in one study and the final chapter is concerned with the manufacture of illuminating oil from oil shales which was so intimately connected with the early history of petroleum refining. F. H. G.

Sixth Symposium (International) on Combustion. Combustion Institute. London: Chapman & Hall, 1958. 224*s*.

The proceedings of the International Symposia on Combustion have become standard reference books for those working in this field. Topics for this Sixth Symposium covered a wider range of subjects than the previous ones, and although the structure and propagation of laminar flames was the subject of 37 papers and formed the major single field presented, turbulent flame propagation (11 papers), high-speed reactions (8 papers), the combustion of explosives and solid propellants (11 papers), vaporization and combustion of droplets and sprays (10 papers), all had a fair representation. The phenomena of flame stability still occupied the attention of jet and rocket propulsion experts (12 papers). On reading the theoretical papers presented, however, it would appear that the engineer cannot but still be discouraged to see the complexity of the theories evolved to explain even the most simple one-dimensional idealized systems. As a compensation, however, an interesting section on applications of combustion (20 papers) served to show the increasing effort being made to bridge the gap between the results of fundamental experiments on ideal systems and the information needed for real advance in combustion technology.

It was interesting to note also the inclusion of papers on the combustion of solid fuels, a choice which is eminently justified in view of the tremendous technological importance of the combustion of coal in the world's economy. The analogies drawn between pulverized coal combustion and that of liquid sprays may indicate that a pooling of some of the results from each of these two fields might be made to their mutual advantage.

The volume can be recommended as an authoritative and up-to-date reference book on the current studies of combustion research. It is perhaps of more interest to the specialist than to the casual reader, but some of the papers are essentially critical review articles, and these alone make the examination of the book well worth while.

M. F. H.

ADDITIONS TO THE LIBRARY

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OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

1479. New concepts alter geological thinking. A. I. Levorsen, *World Oil*, 1957, **145** (7), 105.—Future exploration will be directed more towards stratigraphic type traps and there will be more emphasis on deciphering the geological history of an area together with the analysis of fine details in changes in structure, strike, and rate of dip, particularly where they are associated with permeability barriers. The search in the future will be for trap closure, as distinct from structural closure as in the past, and every area will have to be re-examined for its stratigraphic possibilities.

6 types of map are essential for determining the stratigraphic details of an area; these are: (1) structure maps,

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(2) palæogeologic maps (below each unconformity surface), (3) facies maps, (4) isopach or palæo-structure maps, (5) hydrodynamic maps on formations containing free fluids, and (6) structural and stratigraphical sections. All these are interdependent and, as well as the factual data, there must be the imaginative approach which is more important in stratigraphic exploration than in structural trap exploration.

Stratigraphic exploration is also more expensive in general, more holes being needed to make the discovery; but there are 2 simple rules which always seem to apply in the search under static fluid conditions; (1) move down-dip from a dry well, and (2) move up-dip from a wet well.

The need for the oil geologist to be fully informed on latest technological developments is emphasized. C. A. F.

1480. Considerations on the precipitation of calcium in a marine environment. L. Devèze and C. Duboul-Razavet. *Rev. Inst. franç. Pétrole*, 1957, **12** (4), 493–500.—It has been stated that marine sediments have a high proportion of calcium carbonate (average 40%), whereas terrestrial sediments have a low proportion (average 6%). 3 mechanisms have been widely discussed as being the means of separation of this material in marine environments; bacterial action involved in the nitrogen cycle; bacterial action in the sulphur cycle; physico-chemical processes. These 3 suggestions are briefly reviewed, and some experimental work is described.

The basic relationship is: $CaCO_3 + CO_2 + H_2O = Ca(HCO_3)_2$, and any agency capable of altering the equilibrium position will decide whether there is precipitation or solution. Possible factors include the pH, the amount of CO_2, the amount of alkaline material, the quantity of water, and the nature of the organic material available for the use of microorganisms. The local conditions are important, and the degree of closure affects these. Adsorption may play a part. Marine bacteria may also play a part, but it may be dangerous to link much of the action with specific forms. The various forms of life can modify the physico-chemical conditions in the sea and sediments in such a way as to make possible the precipitation of calcium carbonate. G. D. H.

1481. A method of studying beach features. J. Debyser and P. Lagarde. *Rev. Inst. franç. Pétrole*, 1957, **12** (4), 507–11.—Adhesive-coated transparent plastic ribbons have been employed to take a sample of the surface grains on features such as ripple marks. The size distribution of the grains and the mineral composition at different points on the ripples were determined by observations on the adhering grains. More permanent mounts have been made by transferring the grains to pasty Canada balsam on a glass slip, cooling the balsam, and peeling off the plastic ribbon before putting on a cover glass. Refractive index measurements are then possible. Although there are limitations to the accuracy because of the small numbers of grains involved, the sampling is more reliable in other respects.

The same technique has been applied to sections through beach sands. G. D. H.

1482. Note on a method of preparation of thin slices of fine-grained recent deposits. J. Debyser. *Rev. Inst. franç. Pétrole*, 1957, **12** (4), 489–92.—The structure and the distribution of the components of a sediment are of importance, and for studying these factors thin sections are required and no disturbance should take place in their preparation. The starting point was a core obtained with a coring tube sufficiently wide not to distort the central part. Specimens from the centre were placed in alcohol to displace the water. The liq was replaced every 2 days until all water was extracted. This led to some hardening, possibly due to coagulation of organic matter. Next they were placed in xylene to remove the alcohol, again with changes of the liq, generally over 3 days. Then doses of Canada balsam were added in increasing strength to impregnate the specimens, which were baked at 100° C. Cuts were made with a diamond saw to find out whether there had been sufficient induration, otherwise further baking was carried out. Afterwards thin slices were made in the usual manner.

Examples of thin slices are illustrated, and a recent organic mud from the Baltic is compared with a Kimmeridgian bituminous shale. G. D. H.

1483. Description of a coring device for sampling beach sands. J. Renaud-Debyser. *Rev. Inst. franç. Pétrole*, 1957, **12** (4), 501–2.—Conventional coring devices are difficult to use in sands, and it has been found difficult to get cores even 30 cm long with a 5-cm dia tube in sands of mean dia 300 μ. Moreover, extraction of the core without disturbance was extremely difficult.

The new corer consists of 4 strips with inter-locking edges, which are easily inserted separately to take a rectangular-section core. Moreover, one side can be removed to display the recovered core. The device works well in muds, cores over 1 m in length having been easily obtained.

One corer used elements 100 × 5 cm and 1 mm thick. G. D. H.

1484. Some simple numerical indices for the study of sediments from the geological angle. F. Ottman. *Rev. Inst. franç. Pétrole*, 1957, **12** (4), 503–6.—Sometimes there is a need for simple numerical indices to characterize a sediment without the need for highly specialized equipment. These should be used in conjunction with microscopic and binocular examination.

The coarse fraction is obtained by washing on a 40-μ or 50-μ screen. The insoluble matter is obtained after treatment with hot HCl for 10 minutes. This is non-calcareous, with a predominance of quartz, sometimes felspars, micas, and heavy minerals. In many sediments this is the coarse detritus; in marine deposits it may represent mainly the terrigenous component. Microscopic examination may reveal sponge spicules, or casts of foraminifera in glauconite, silica, or phosphate.

The calcium carbonate content may be obtained on the coarse material, the fine material, or the entire sample.

The criteria mentioned differ markedly for globigerina mud, Mediterranean littoral mud, muddy sands, calcareous loess, plastic clay, and clayey sands. Several examples are discussed, one showing these factors in relation to weathering and another lateral variation. G. D. H.

1485. Two-stage gravimeter measuring procedure. (In German.) S. Thyssen-Bornemisza. *Erdöl u. Kohle*, 1957, **10**, 8–9.—Vertical gravity gradients can be determined with the gravimeter with ±10 E.U. accuracy in the terrain, by using a vertical measuring step of exactly 4 m ht. Wind effects are felt at >4 m. The procedure is discussed relative to Calgary region and Turner Valley profiles. Terrain correction is unnecessary outside a 3-m-radius ring. Tabulated results show wide variation in measured and calc vertical gradient. Measurements with the torsion balance and the gravimeter are compared. R. T.

1486. Discovery of stratigraphic traps by reflection seismograph. G. H. Westby. *Oil Gas J.*, 17.3.58, **56** (11), 144–56.—The application of seismic methods to the discovery of stratigraphic traps is discussed. To date these methods have been effective in discovering pinch-out type traps in 2 Coalinga fields, the Golden Trend area of Oklahoma, in the W. Edmond area, and in the Majeau Lake field, Alberta. A buried sand bar, 60 ft thick by 1000 ft wide, responsible for the Ceres pool, Oklahoma, was located by variations in the interval between 2 limestones above it and below, indicated by seismic reflections. Continuous velocity logging and the derived reflection coeff log are regarded as the most important new tools to aid

the location of stratigraphic traps. Synthetic reflection records prepared by suitable equipment from the reflection coeff log show the reflection log which should be obtained in a given sequence of beds. Comparison with actual reflection logs may enable the distribution of discontinuous sand bodies (potential stratigraphic traps) to be deduced. J. C. M. T.

1487. Aerial colour photography. Anon. *Oil Gas J.*, 17.3.58, **56** (11), 122–4.—Colour air photographs reveal subtle colour changes in soil, vegetation, and surface outcrops not always detectable in the shades of grey rendered by black and white photographs. A process has been perfected for making coloured mosaics quickly and at reasonable cost. 2 S. Texas operators claim to have made new field discoveries on the basis of colour air photographs. J. C. M. T.

1488. U.S. pool maps. Anon. *Oil Gas J.*, 17.3.58, **56** (11), 105–20.—16 up-to-date maps showing the location of the principal oil and gas pools of the U.S.A. are provided. J. C. M. T.

1489. Multiple folding in the Appalachian basin. H. P. Woodward. *World Oil*, 1957, **145** (7), 110.—It is commonly assumed that the Appalachian structures of the NE. part of the U.S.A. are all due to the Appalachian movements at the end of the Palæozoic era, but evidence has shown that there were at least 3 separate periods of deformation in the Appalachian oil and gas basin, each of which provided favourable trap structures. These periods were in the pre-Silurian, late Devonian, and late Palæozoic and the trends of the orogenies do not match exactly, nor do the areas affected coincide. Diagrams show the fold pattern in the basin of each of the orogenies, and these emphasize the need for careful historical and structural analysis of each area to be tested. This is particularly important for determining facies changes, as structural and stratigraphic features are interrelated in this region.

Another complication is Triassic diastrophism, which has affected parts of the area, such as the Lackawanna syncline. In exploring the Appalachian area it is suggested that, as a first step, the areas of reservoir possibilities for a target horizon should be predicted, and then a structure where entrapment was likely should be sought. C. A. F.

1490. Photogeology finds a place in the Four Corners. L. E. Bogart. *Petrol. Engr*, 1957, **29** (13), B53–62.—Bold outcrops, lack of vegetation, colourful stratigraphy, and a wide variety of lithologies make the Four Corners area very suitable for photogeological interpretation purposes. The study of aerial photographs is a short way of obtaining information on the overall structure of an area, and determining which areas require thorough survey. Suitable well-sites and routes to them may be easily chosen and rights-of-way planned for pipelines. A. E. R.

1491. Ordovician pay zones attractive in S. Oklahoma. F. P. Schweers. *Oil Gas J.*, 17.3.58, **56** (11), 126–31.—$\frac{1}{2}$ of current U.S. oil production comes from S. Oklahoma, along the Wichita–Criner Hills axis and associated flanking anticlines. In the past these structures have produced abundantly from Middle and Upper Pennsylvanian formations, but Lower Pennsylvanian and pre-Pennsylvanian strata now account for nearly $\frac{1}{3}$ the area's production rate. Most important pre-Atokan production at present is from the Springer sandstones. Future reserves are probably in older and deeper horizons. 2 major and at least 2 minor epochs of diastrophism have been responsible for the folding of this region. Maps of geology and distribution of oil pools are provided. J. C. M. T.

1492. Gas trend blossoming. Anon. *Oil Gas J.*, 17.3.58, **56** (11), 90.—2 new gas discoveries have been made in the Alberta foothills belt of the Canadian Rockies. The wildcats are at Panther River (7200 M.c.f/day from the Devonian at 9009–9166 ft) and Lovett River (17,000 M.c.f/day from the Mississippian below 10,000 ft). J. C. M. T.

1493. The oil geology of South America. J. C. M. Taylor. *Petroleum, Lond.*, 1958, **21** (3), 79–82.—S. America possesses a lower proportion of marine sedimentary rocks than N. America, due to the less extensive inroads of the sea. So far the greater part of oil production has appeared from basins of Mesozoic and Tertiary rocks associated with the fold belt of the Andes, and most activity is confined to the N. of the belt. Much of the continent remains to be explored and development may reveal other fields in the extensive basins of the continent, such as that found in the Amazon basin of Brazil. A. E. R.

1494. Venezuela is divided into three basins. G. Zuloaga. *Petrol. Engr*, 1957, **29** (12), B21–7.—There are 3 main distinct petroliferous basins in Venezuela which occupy wide, mostly coastal areas, and a fourth basin, practically unexplored, stretches out to sea. Regional geology and the development of major fields are described. A. E. R.

1495. Ancient coast lines on the continental shelf of West Guiana (South America). D. J. G. Nota. *Rev. Inst. franç. Pétrole*, 1957, **12** (4), 432–9.—Ultrasonic soundings have been used to determine the sea-floor profiles along a series of lines from the Orinoco delta area to the Essequibo river. Especially in the SE. these show terraces, at depths of *ca* 12–13 and 30–38 fathoms. In addition, in the SE. the margin shows a slope of *ca* 5°, whereas in the W. the slope is *ca* 1°.

Studies of the sediments have shown several zones. Near the coast there are pelites, then a belt of sand and pelite, followed by a strip of calcarenite and pelite. Doeglas concluded that streams would not carry sands beyond a depth of *ca* 10 m. It was inferred that sands at greater depths must have been carried out by rivers at a time when the sea was lower. Mineralogical and other studies suggest that in the Pleistocene the sea was 30–40 fathoms lower. G. D. H.

1496. A short history of exploration in Kuwait. A. F. Fox. *World Petrol.*, 1957, **28** (10), 94.—Oil and gas seeps had been known in various parts of Kuwait before exploratory drilling was first started in 1936. The first well which was drilled at Bahrah on a surface anticline was unsuccessful, but subsequent geophysical surveys outlined a marked feature at Burgan, which was tested in 1937 with successful results. From 1938 to 1942, 8 additional wells were drilled in the Burgan field, but further development did not take place until 1946. Since then there has been extensive development drilling of the Burgan field, and additional discoveries have been made at Magwa, adjacent to Burgan to the N., at Ahmadi to the NE. of Burgan, and at Raudhatain in N. Kuwait.

Production comes from Middle Cretaceous sands in anticlinal structures which show radial faulting at Burgan and Magwa, and transverse faulting at Ahmadi. The folds were developed during long periods from the Cretaceous through to the Tertiary, and they are superimposed on the N. flank of a deep-seated structural trend which extends into Saudi Arabia.

The oil in the fields shows a marked increase in gravity with depth, lighter oil occurring at the top of each reservoir and becoming heavier as the oil–water contact is approached. It is suggested that this is due to segregation of the oil into zones of different gravity during secondary migration, in which activated quartz grains selectively adsorb crude oil molecules during differential entrapment, light molecules being displaced by heavier.

Diagrams show the structure of the Burgan group of fields and the stratigraphy of SE. Kuwait. 5 refs. C. A. F.

1497. Two strikes by Aramco. Anon. *Oil Gas J.*, 10.3.58, **56** (10), 102.—2 new-pool discoveries have been made in Saudi Arabia, one of them in a new pay zone. Khurais 1, in the Dahana region E. of the Central Plateau and 75 miles W. of nearest production, tested 3000–4000 b.d. of 33° API sour crude from the D member of the Arab zone at *ca* 4975 ft.

Manifa 1, 8 miles offshore in Manifa Bay, has tested 26° API crude at " highly prolific " production rates from 7715–7800 ft and 7810–7865 ft in the Lower Cretaceous Yamamam calcarenite. This formation, not productive elsewhere in Saudi Arabia, is the equivalent of the Ratawi zone of the Neutral Zone. The A, B, and C members of the Arab zone were also found to be oil-bearing. J. C. M. T.

1498. Khurais is farthest inland discovery in Saudi Arabia. H. T. Brundage. *World Oil*, 1957, **145** (7), 181.—Oil has been found by Khurais 1, a well drilled in E.-Central Saudi Arabia *ca* 150 miles from the Persian Gulf and 90 miles NE. of Riyadh. It is the farthest inland discovery in the country, and initial tests indicate a potential of up to 3000 b.d. Pay is the Jurassic Arab D zone, which is productive in the Ghawar field and outcrops near Riyadh. Further wells are to be drilled in the area to delineate the field. The discovery was sited on a structure located by gravity surveys in an area of active sand dunes E. of the central plateau. C. A. F.

1499. Wintershall A.G. discovers major German gas field. Anon. *World Oil*, 1957, **145** (7), 192.—A natural gas field has been found NE. of Diepholz by Dueste Z 1, which on test produced high pressure gas from 10,328 ft. Pay is probably the main Zechstein dolomite. C. A. F.

1500. Micropalæontological organization of the non-marine Keuper. (In German.) C. A. Wichter. *Erdöl u. Kohle*, 1957, **10**, 3–7.—E. Germany is richer in fossils, on the whole, than NW. Germany. Within the total Keuper in E. Germany the Middle Keuper is the type—and individual—poorest. In the Rhaetic and Keuper the most stratigraphically important microfossils are foraminifera of the marine complex, ostracods in the brackish and fresh water complex, and spores in the terrestrial complex. Microfossils present in the same horizon in E. and NW. Germany are alike and in the same sequence. Many index fossils occur also beyond Germany in other European countries. Plates include stratigraphic distribution of index fossils in the Keuper with 33 drawings and descriptions of the species, and drawings with explanations of 19 non-marine microfossils of the Keuper. 7 refs. R. T.

1501. Coastal sands of the Spanish Levant: the beaches of Valence. J. P. Mateos and J. P. A. Pascual. *Rev. Inst. franç. Pétrole*, 1957, **12** (4), 440–2.—The coast of Valence is of recent origin. As a consequence of movements, the rivers have brought a lot of sediment which has contributed to the coastal plain, which continues several km under the sea because of subsidence. The Jucar and Turia now contribute by the fusion of their deltas, and the Palancia and Serpis have played a part in forming the Quaternary coastal plain. Jurassic, Triassic, and Cretaceous outcrops have affected dune formation.

The fluviatile materials do not contain augite, except those of the Palancia, which have a high proportion of titaniferous augite. The sands showed considerable mineralogical homogeneity: augite is common and abundant, hornblende is less frequent, occurring as a brownish basaltic variety. Fragments of trachytes and trachy-andesites have been found on the beaches, probably brought by marine currents from the Columbrettes Isles or from submarine lava flows 40 km to the S. G. D. H.

1502. The sandy coasts of Galice (Spain). J. P. Pondal and J. P. Mateos. *Rev. Inst. franç. Pétrole*, 1957, **12** (4), 443–8.—The mineralogical composition of the sands has been studied and comparisons made with the geology and petrology of the area. There are zones in which a heavy mineral or group of heavy minerals is dominant. A great ilmenitic zone runs from Carballo to Grove, and inside this is the monazite zone of Finisterre and the zircon zone of Caldebarcos. A magnetite zone occurs at Vivero, a chromite zone at Ortigueira, and a monazite zone at Vigo.

The beaches and dunes of Ria de Lage show an ilmenite–garnet–epidote suite, and the dunes a tourmaline–andalusite–hornblende suite. These are derived from neighbouring granitic and metamorphic rocks.

Details of the mineralogical composition of the beach and dune sands of the Finisterre area are given, and the structure and make-up of the adjacent rocks are noted. The Langosteira beach and dunes are extensive, with the beach sands containing monazite. The Finisterre zone has minerals of magmatic and metamorphic origin, the former giving ilmenite–tourmaline–hornblende and rutile–monazite–zircon, and the latter andalusite–garnet–epidote, and staurotide–sillimanite. G. D. H.

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

1503. Research in oilfield geophysics. J. J. Glogoczowski and Z. Jaszczewski. *Nafta (Krakow)*, 1957, **13**, 267.—The Section for Geological Research at the Polish IP was established in 1948 and now, as the Geochemistry, Geology, and Geophysics Section it covers all the field of investigations. Its first job was radiation logging of boreholes. Initially using a Geiger counter, it eventually evolved a fully automatic device which, with the help of the Warsaw University Dept of Physics, has since been improved. For neutron logging a source consisting of $RaBr_2$ was brought into use in 1955. Lacking any previous records, the efficiency of the instrument has been tested at the Experimental Oilfield at Kroscienko-Wyzne, but more field work is now being done. Gas logging was based on automatic equipment made by Windbrechtiger for mud analysis which was successfully adapted. Too delicate in construction, this was replaced by an industrial model especially devised which has proved itself already. Analytical apparatus based on combustion of hydrocarbons has been developed from a similar device used in coal mines. Radioactive Zn and labelled sand have been used for control of movement of subterranean waters and fracturing experiments. To enable electrical logging to be correctly interpreted coeff were adapted from literature for each geological formation, but a great deal of lab work is still necessary. New to the Polish IP is work on the electromagnetic wave reflection in oil-bearing formations, and this is pursued on a lab scale. 2 other items of equipment are being developed. They are a battery echometer and an electrical " explosimeter " which, being portable, might be of wider use. M. S.

1504. Prospects of geophysical surveying work in the petroleum industry. K. Sojka and J. Zytka. *Nafta (Krakow)*, 1957, **13**, 289–91.—Bearing in mind the tremendous developments in this method of prospecting all over the world, the recent increase in this activity in Poland, where from 2000 jobs in 1945–55 the numbers have risen to 5000 in 1½ years, is wholly welcome. Some useful results have already shown the advantages of this acceleration in geophysical work. Together with seismic work, it is expected to contribute by 1960 to the solution of many problems. M. S.

1505. What causes variations in radioactivity over oil pools? J. A. Miller. *Oil Gas J.*, 10.3.58, **56** (10), 245–6.—In explana-

tion of the reported correlation between the " halo " distribution of radioactivity and hydrocarbons in the soil over some oil pools, the author suggests that radioactive elements normally present in the formations form complexes with unsaturated hydrocarbons and are then carried to the surface in solution in the escaping hydrocarbons, being re-precipitated by the oxidizing conditions in the soil. The low values over the centre of the pool are thought to be due to the prevalence of methane (which does not form radioactive complexes) escaping upwards from the gas cap. J. C. M. T.

1506. Geophysical service of the petroleum industry. K. Sojka *et al.* *Nafta (Krakow)*, 1957, **13**, 270.—A review of results achieved by seismic prospecting in Poland between 1945 and 1957. In the Carpathians work done showed no positive results and was of little effect on oil development. In the Carpathian foothills the effects of work done were greater, since it solved several problems of a geological nature. In the lowlands little work was done and generally over small areas, but it revealed the Goplo anomaly, the details of structure at Turek, and an anomaly at Chojnice. Whilst from 1945 to 1955 only 2000 km of seismic profile work was done, 3000 km p.a. has been done since. The current work covers: (1) Carpathian foothills, where Lubaczow and Tarnogrod regions are being closely investigated; (2) Sudeten foothills (monoclinic); (3) Lodz–Szczecin (Stettin) syncline, where the discoveries in the Mogilno, Goplo, and Turek areas are being followed up; (4) Pomeranian (maritime) anticline with its coastal syncline, which is the subject of detailed work; and (5) geophysical oilfield research. The latter, by means of groups attached to various fields and wells, is rapidly developing and yielding information through logging. Magnetic recordings of the work done are unsatisfactory, and a great deal must yet be done to identify the underlying geological strata. M. S.

1507. Notes on interpretation methods of waves reflected from steep structures in the lowlands. Z. Sliwinski. *Nafta (Krakow)*, 1957, **13**, 281.—In interpretation of the data accumulated during the 1956 work approximations have been used which should be applied only to formations consisting of parallel layers of rocks. Wherever propagation of waves is non-rectilinear, results based on first approximation are valueless. The author brings to the notice of geologists the theories relating to more advanced methods and points out how the results so obtained differ from those derived previously. M. S.

1508. On the composition of Mogilno structure on the basis of seismic prospecting and exploratory drilling carried out up to the present. K. Mrozek and K. Sojka. *Nafta (Krakow)*, 1957, **13**, 278.—Over 20 seismic profiles were completed, and several are illustrated. The authors believe that an accumulation of hydrocarbons is a possibility in this area. M. S.

1509. Results of seismic prospecting in the region of Carpathian foothills. S. Drwila and J. Zytka. *Nafta (Krakow)*, 1957, **13**, 275.—Work described was done around Lubaczow in 1956. Some 20 profiles were taken, and all work is presented with the aid of 5 diagrams. M. S.

DRILLING

1510. Perlite additive improves cement characteristics. P. B. Crawford and H. T. Kennedy. *World Oil*, 1957, **145** (7), 117.—Over 2 years experience in the use of perlite as an additive in primary cement jobs in the U.S.A. and Canada has shown that it gives a lighter slurry with better strength and setting properties and the set will perforate without shattering. The additive most used is a mixture of expanded and unexpanded perlite, and slurries as light as 12·2 lb/gal can be prepared. It has little effect on pumping or thickening time, and it is being used extensively in Louisiana on casing and squeeze jobs at depths below 14,000 ft with bottom hole temp above 250° F. Diagrams show the properties of the perlite slurry. 2 refs. C. A. F.

1511. A method of economic analysis of effectiveness of exploitation drilling in the petroleum industry. A. Kumanowski. *Nafta (Krakow)*, 1957, **13**, 303–8.—In cases of wells sunk for purposes of exploitation, data required for analysis are: (1) production in first year; (2) same per depth in m; (3) production in the first 25 years; (4) same per depth in m. Due to the obvious inadequacy of these the following are suggested instead: (*a*) anticipated production; (*b*) probable geological cross-section; (*c*) cost of drilling, etc.; (*d*) cost of connecting up; (*e*) other capital costs; (*f*) running costs. Anticipated production can be estimated only on the basis of the known production of nearby boreholes, whilst knowledge of (*b*) is required to evaluate (*c*), and (*f*) must include the anticipated power expenditure and wear and tear and amortization costs. If production is a function of time, $y = f(x)$, then total amount of crude × its value $a = Z$ or $Z = a\int_o^x ydx = \Phi\ (x)$. Total investment after x years is $I = (c) - (d) - (e) - x\,(f)$. From the comparison of these data it appears that the well will as a rule bring a profit after the investment expenses have been recovered and will continue to do so as long as falling production rate compensates for the running expenses and amortization costs. By means of differential equations total cost, total profit, production, and its likely duration can be calculated. M. S.

1512. Better fluid recovery on drill-stem test. E. V. Lancaster, H. E. Schwegman, and W. H. Wright. *Oil Gas J.*, 10.3.58, **56** (10), 186.—A new tool to wash and clean the face of the formation prior to taking a drill-stem test is described and illustrated. The tool is run directly above the testing device, and incorporates a charge of suitable acid which shrinks water-swollen clays, dissolves carbonates, and breaks emulsions before releasing the fluids into the drill pipe. This action remedies damage done to the formation during drilling which might otherwise prevent the formation from showing its full productivity. 4 examples of tests carried out by this method, showing the advantage over standard methods, are given. J. C. M. T.

1513. A high-temperature oil well cement. I. R. Dunlap and F. D. Patchen. *Petrol. Engr*, 1957, **29** (12), B60–8.—Recently a need for retarded oil well cements that may be safely placed at depths exceeding 15,000 ft and at bottom-hole temp over 300° F has developed. Lab tests and field applications of carboxymethylhydroxyethyl cellulose (CMHEC) have shown that this cpd has a significant retarding effect upon slurries of Portland cement at the above conditions for quantities as low as 0·4 wt % of CMHEC. A low slurry visc is maintained for extended periods, and other cement properties, such as density, fluid loss, and compressive strength, are found good. A. E. R.

1514. Gas drilling and gas well completions in the San Juan basin. M. B. Jones. *Petrol. Engr*, 1957, **29** (13), B64–78.—In the San Juan basin natural gas flows are small due to the low permeability and porosity of the producing strata, so that fracturing techniques are widely used. Selective fracturing was developed so that the most promising production zones received treatment. The use of rubber ball seals controls the number of perforations that break down, eliminates zone separation by bridging plugs, and in some cases investigated reduces the injection rate required. Parts of the wells were drilled with gas to reduce drilling time. A. E. R.

1515. Four Corners drilling and completion methods with money-saving motives. D. M. Taylor. *Petrol. Engr*, 1957, **29** (13), B26–31.—High drilling costs in the Four Corners area have initiated more economic techniques. Drilling costs were reduced by contracting several wells, setting smaller casing, and, in well completions, pumping the cementing plug down with lease crude. Cable-tool rings were used for completion. Shallow artesian water flows were overcome by drilling with water, making provision for flows. Water flows during gas drilling were shut off by increasing the operating pressure and blowing the cuttings back into the water-producing formation. Gas lift valves were used on gas wells to produce water left in the formation after fracturing and to avoid dangerous and expensive swabbing. Fracturing with paraffin solvent followed by natural gasoline and no sand resulted in a trebled producing rate in one well. In a waxy shale with stringers of calcite, which made conventional mud drilling difficult, a mud containing 38% oil, with an emulsifier and wood fibre, greatly increased penetration rates. Lightweight high-visc air-entrained cement with silica and cellophane strips reduced water loss and penetration of the cement into the formation and increased initial well production potential. A. E. R.

1516. Interpretation of radioactivity logs in the Paradox basin. V. C. Stephenson and K. Simmons. *Petrol. Engr*, 1957, **29** (13), B32–3.—In the Paradox basin of the Four Corners area formation composition and porosity vary widely in neighbouring wells. A new calibration system used in interpreting radioactivity logs enables a well-to-well comparison of reservoir materials and porosities to be made so that the productive zones may be defined and perforating intervals evaluated. A. E. R.

1517. Density logging with gamma rays. P. E. Baker. *J. Petrol. Tech.*, 1957, **9** (10), AIMME Tech. Paper No. 4654, 289–94.—The logging device employs back-scattered γ-rays with energy discrimination to select only that energy range corresponding to the deepest penetration. Collimators are used for the source and detector, the latter being a scintillation counter. Lab tests were made in simulated boreholes, using materials of different density, and empty or fluid-filled boreholes of various sizes. Since the device is held against the well wall there was no borehole size effect, but mud cake and wall roughness had effects, although they are not expected to be serious because correction is possible. An accuracy of $\pm 2\%$ was obtained in the lab density measurements.

In field tests the γ-ray density log correlated accurately with other logs, and there was satisfactory agreement between core and density log data. G. D. H.

1518. Mud additive extends life of drill bit. Anon. *Oil Gas J.*, 24.2.58, **56** (8), 94.—Gulf Oil Corpn claims that use of a new EP lubricating additive in drilling muds may cut drilling time by 12½–25%. Often, drill bit bearings fail before the teeth, but when the EP additive is used the bearings outwear the teeth and the life of the bit as a whole is increased by 2–5 times. Not only are round trips saved, but the torque necessary to rotate the drill pipe may be reduced by $\frac{1}{20}$ of that where conventional muds are used. Oil emulsion, bentonite, conventional clay, and weighted muds all showed improvements when EP cpd was added. These claims are based on tests at the company's research centre and field trials in W. Texas. J. C. M. T.

1519. Degassers. C. R. Graham. *Petrol. Engr*, 1957, **29** (13), B81–2.—Closer control limits of drilling mud properties has led to the development of the degasser, which removes gas and volatile hydrocarbons from the mud, to avoid the possibility of a blow-out if the mud is thick enough to prevent the release of most of the entrained gases to atmosphere when they reach the surface. The mud is passed over a system of sloping baffles in the degasser which spread it into a sheet. Vacuum is applied to remove light hydrocarbons. Maintenance costs are low due to the presence of few moving parts. A. E. R.

1520. Biggest LeTourneau drilling barge launched. J. W. Calvert. *World Petrol.*, 1957, **28** (12), 82.—A new design of drilling barge has recently been launched for offshore operations in the Gulf of Mexico. It consists of a self-elevating platform mounted on 3 lattice-work spuds. It is completely powered by diesel-electric, with overall dimensions of 176 ft 2 inches in length and width, and 151 ft 9 inches in height. It is claimed that it can drill in up to 85 ft of water, assuming a 15-ft penetration of the bottom and a 45-ft clearance between barge bottom and sea level. Details of the power equipment and method of spudding and elevating the barge are given and diagrams show the method of operation. C. A. F.

1521. Creole's revised classification of hazardous areas on drilling barges. J. C. Muhlenberg. *Petrol. Engr*, 1957, **29** (12), B143–68.—As a safety precaution against fires a classification of hazardous areas on offshore barges used on Lake Maracaibo has been effective in eliminating fires caused by electrical equipment. A. E. R.

1522. Something new in offshore drilling. Anon. *World Oil*, 1957, **145** (7), 138.—A 4-unit drilling team recently introduced for offshore work in the Gulf Coast area comprises a drilling tender, work boat, drilling rig, and platform tender. The tender, which is the most powerful to operate in the Gulf, is self-propelled, and the main power units were designed for drilling operations and for propelling the ship. Many safety features have been built in which will reduce insurance rates. A hydraulically-operated platform launching barge has been introduced, and this will eliminate the need for an expensive construction barge and crane when moving locations. Drilling equipment is electrically driven and consists of a unitized 2000-h.p. rig with the drawworks mounted below the rig floor. It is designed for drilling to below 20,000 ft. C. A. F.

1523. Capital budgeting for petroleum operations. H. N. Mead. *Petrol. Engr*, 1957, **29** (13), B89–100.—A capital budgeting procedure applicable to an oil company intending to drill exploratory holes is described in basic concepts. It is convenient that separate budgets be made for exploration and the exploitation of known reserves. A. E. R.

PRODUCTION

1524. Advances in secondary production techniques. Anon. *Petroleum, Lond.*, 1958, **21** (3), 88–9.—Attempts are being made to raise the extracted proportion of oil present in a field to over 50% by the use of secondary recovery techniques. Water flooding and repressuring by the injection of gas are standard methods of recovery described, and each goes through a pilot-project stage with small variations due to local conditions and economics. Recently a combination of LPG followed by dry gas injection has been used to increase recovery. A. E. R.

1525. Progress in well-completion methods. Pt 1. L. C. Uren. *World Petrol.*, 1957, **28** (10), 108.—Much progress in well completion and related techniques has been made during the last 30 years, and some of the more important recent developments are described, the need for accurate well logs, formation tests, and core samples being emphasized.

Methods of prevention of plugging of reservoir pores by clay before completion include wall-scraping and "scratching" tools of various kinds, and the use of "mud acid." Oil-base

or emulsion muds avoid formation contamination by water.

For water exclusion in well completion, various methods have been evolved which use cement, plastic, or chemical reagents that yield precipitates which clog the pores of water-bearing formations.

Arrangements for well casings and tubing through the producing formation are briefly noted, and the recently developed " permanent " type of completion is described; this is claimed to be cheaper than conventional methods. There have been important developments in multi-zone completions and bullet perforation, particularly the jet perforator, which is now widely used. Research on improved methods for jet perforating is continuing, but bullet type perforation is still preferred in some areas. Details of both methods are given. C. A. F.

1526. Does the inhibitor squeeze method work? R. H. Poetker, P. C. Brock, and S. A. Huckleberry. *Petrol. Engr*, 1957, **29** (13), B102–7.—Treatments in which corrosion inhibitor is pumped into producing formations may control corrosion of well tubing and downhole equipment for up to 6 months. The method was tested over a 2-year period in wells in Louisiana and Texas. Complete tubing protection is obtained, while treating time and shut-in time are reduced. A. E. R.

1527. Depletion calculations for segregation drive. T. A. O'Brien. *Petrol. Engr*, 1957, **29** (12), B28–32.—The prediction of future reservoir behaviour under both primary and secondary recovery conditions is possible even if only a short producing history is available due to injection being commenced early. Segregation effects in high permeability or steep-dipping sands markedly affect the performance of a solution gas drive reservoir below the bubble-point pressure. Calculations allowing for these effects are presented. A. E. R.

1528. Surfactant treatment selectively seals off water entry. W. E. Brown. *Petrol. Engr*, 1957, **29** (12), B72–86.—Excessive water production zones are costly because of pumping, separation and disposal difficulties, and reduced oil production. The injection of an unusual surface-active agent mixed in crude oil has proved effective in selectively shutting off water entry into the well bore of a producing oil well. Reservoir rock becomes oil-wet and an oil–water emulsion is formed where water is present. At pore constrictions the water is broken into droplets which block further water entry without restricting oil production. The process is not applicable if water and oil are produced either concurrently or alternately from the same pores. The treatment has been found to remain effective for over 6 months. A. E. R.

1529. Cause, prevention, evaluation, and cure of formation damage. C. Gatlin. *Petrol. Engr*, 1957, **29** (12), B102–18.—Formation damage is caused by the entry of foreign fluids or solids into the reservoir adjacent to the well bore, and the loss of permeability results in decreased production. Drilling mud is the source of many contaminants, but cement invasion may be detrimental. Damage may be prevented by selecting a suitable drilling mud and using mud filtration. The evaluation of damage is discussed using pressure build-up mechanics. Damage may be cured by well stimulation involving fracturing, acidizing, or shooting. 20 refs. A. E. R.

1530. Consider these factors for optimum pumping. D. O. Johnson. *World Oil*, 1957, **145** (7), 153.—Factors to be considered for optimum pumping are discussed, the most important being: (1) vol of fluid in b.d.; (2) net lift in ft; (3) specific gravity of fluid; (4) gas–oil ratio; and (5) visc of fluid. A series of charts is given to show optimum pumping conditions, and it is emphasized that an attempt should be made to achieve these conditions by the best selection of the equipment to meet the requirements of the individual well. A table shows the pump plunger sizes recommended for optimum conditions. C. A. F.

1531. A mathematical basis for gas well open flow calculations. F. W. Cole. *World Oil*, 1957, **145** (7), 158.—The mathematical basis for the conventional back-pressure testing of gas wells for determining their theoretical production under open flow is briefly presented. It is developed from the basic Darcy radial flow equation modified for compressible fluid flow, reservoir flow rate being converted to surface flow at standard conditions of temp and pressure using the perfect gas laws. C. A. F.

1532. New chart simplifies log interpretation. R. P. Alger and G. A. Griswold. *World Oil*, 1957, **145** (7), 133.—A simplified method of electric log interpretation is presented which makes use of a new chart which is given. This uses direct readings from the induction-electrical log to give a value of water saturation in potential pay sands and is a revised form of the chart presented by Dumanoir, Tixier, and Martin. Data required to use the chart are short normal resistivity (R_{16}''), induction log resistivity (R_{IL}), mud filtrate resistivity (Rmf), connate water resistivity (Rw), and SP. The method is applicable to clean and shaley sands, and its limitations are described. Invasion effects are taken into account by their relative influence on R_{IL} and R_{16}''. An example of the use of the chart is given. C. A. F.

1533. Pros and cons of jet and bullet perforators. L. V. McConnell. *World Oil*, 1957, **145** (7), 169.—Intensive research on perforating techniques has improved the efficiency of bullet perforating, so that the depth of penetration by bullet can now compare with that of the shaped charge. Criteria for deciding which of these techniques should be used in well completion are discussed briefly, together with recent developments in perforating methods. Diagrams show a comparision between penetrations by bullets and jet charges for different types of gun and hole size. C. A. F.

1534. Why use multiple parallel string completions? J. R. Feeser. *World Oil*, 1957, **145** (7), 159.—The use of parallel retrievable independent multiple string equipment in well completion is described. This type of completion has become accepted practice for multiple zone fields, and it has almost all the advantages of a single completion and allows simultaneous artificial lift of multiple zones. The technique is *ca* 3 years old and has been used to date in over 2000 wells. The equipment is standard, excepting multiple string packers, well heads, and artificial lift equipment in certain cases. A conventional pumping installation for 2 zones with parallel strings uses one packer set above the lower zone and a parallel string anchor which is used above the upper zone.

Details are given of the equipment with diagrams showing the well arrangements. 4 refs. C. A. F.

1535. Note on transient two-phase flow calculations. G. C. Wallick. *J. Petrol. Tech.*, 1957, **9** (10), 47–9.—In investigating the feasibility of solving problems of 2-phase unsteady-state flow by means of a Datatron computer it was found that there was an error in the linear solution previously given by West, Garvin, and Sheldon. The gas/oil ratio–cumulative recovery plot attained a peak earlier than in the computations of West *et al.* When the error in the early publication was corrected good agreement was obtained up to a cumulative recovery of 4%. The Datatron solution, however, gave a more rapid well-pressure decline. When the producing rate was decreased for a series of calculations it was found that the resultant curves approached the gas/oil ratio curve for the standard material balance calculation, as expected.

In applying the Datatron to the radial flow case, using a programme involving a blend of fixed and floating-point arithmetic, satisfactory agreement was obtained with West *et al*'s results, except that an apparent break or discontinuity occurred where the change was made from production at constant rate to production at constant pressure.

The effect of boundary conditions was studied, there being negligible differences for the cases examined. G. D. H.

1536. Estimated effect of horizontal fractures in thick reservoirs on pattern conductivity. B. L. Landrum and P. B. Crawford. *J. Petrol. Tech.*, 1957, **9** (10), 50–2.—The electrical models used had copper sheets to simulate horizontal fractures, the well being a copper wire. Square and staggered line drive patterns were studied with fractures in the centre of the pay. There was generally substantial improvement when all wells were fractured instead of only one. It was found that one large fracture was more effective in increasing conductivities than several fractures of $\frac{1}{2}$ the radius.

For thin pays a fracture is almost as effective as if the well were as large as the fractures. For thick pays, and especially for large fractures, the centre of the pay is more responsive to fracturing than the top or the bottom. Fractures in the centre well of a 7-spot pattern are better than fracturing all the other wells in the pattern to the same extent.

G. D. H.

1537. Interpretation of capillary pressure data from carbonate reservoirs. W. R. Aufricht and E. H. Koepf. *J. Petrol. Tech.*, 1957, **9** (10), 53–6.—Lab data on capillary pressures can be converted to curves of water saturation at different heights above the base of the transition zone, assuming that the rock is uniform. From relative permeability measurements the water cuts in production from the different levels can be obtained via the saturations.

When the reservoir rock has layers with different capillary properties a series of curves is needed to give the data on water distribution and the water cut. The transition zone will be altered.

A field example is described to illustrate the changes in water saturation and in water cut with level, and it is noted that high permeability sections may dominate the producing behaviour.

In some cases porosity rather than permeability may be used as the correlating parameter, and this may be preferable when the porosity is due mainly to fractures and vugs. For very heterogeneous rocks a combination such as the square root of the permeability over the porosity may be employed.

G. D. H.

1538. Application of large computers to reservoir engineering problems. D. G. McCarty and D. W. Peaceman. *J. Petrol. Tech.*, 1957, **9** (10), 14–18.—Automatic computers have applications in developing engineering information more economically and in the production of improved engineering analyses. They can be employed in studies involving variation of the input data, which may lead to indications that the answers are relatively insensitive to some of those data, in which case uncertainties in those data are not of great concern. The best mode of operation of a project may be selected by examining the effects of changing certain variables.

Various types of reservoir problem are considered, and the kinds of mathematical difficulties involved are indicated. In addition, the types of problem amenable to numerical methods are noted. Examples of different types of flow problems are given, and the computational requirements for various single-phase flow problems are listed. The extension of Laplace's equations to non-uniform regions is discussed, and reference is made to 2-phase flow.

On the basis of experience with an IBM 704 computer the time requirements are given or estimated for solving various reservoir problems and compared with the times needed with a magnetic drum computer. The latter requires 1000 times the time taken by the former. G. D. H.

1539. Use of transparent three-dimensional models for studying the mechanisms of flow processes in oil reservoirs. P. van Meurs. *J. Petrol. Tech.*, 1957, **9** (10), AIMME Tech. Paper No. 4634, 295–301.—The models employed finely powdered glass to simulate sand grains, in a glass container with an oil of the same refractive index as the glass, making the whole transparent until water or gas was injected. The loss of transparency showed the advance of the displacing fluid. Linear water floods were studied for homogeneous formations, with different visc ratios. The advance was fingering when the oil/water visc ratio was high. Stratified formations were similarly studied. Much of the water in the fine lower layer entered from the coarse layer. For both homogeneous and stratified formations recovery was highest at the low visc ratios.

5-spot floods were investigated, with results agreeing closely with theory, and solution gas drive was studied in tubes of glass grains. When the tube was not tapped gas was evolved only near the outlet end of the column; with tapping there was more general evolution and more rapid production.

A depletion experiment was followed by water injection to demonstrate the formation of an oil bank in secondary recovery. G. D. H.

1540. Laboratory study of gravity segregation in frontal drives. F. F. Craig *et al*. *J. Petrol. Tech.*, 1957, **9** (10), AIMME Tech. Paper No. 4649, 275–82.—The effects of gravity on oil recovery have been studied in scaled reservoir models for water, gas, and solvent frontal drives. Gravity differences lead to non-uniform advance of the flood front, reducing sweep efficiency. Linear and 5-spot floods in horizontal strata were investigated, using ranges of rates, formation thickness, rock and fluid properties comparable with those met in field operations. The models used sand or plastic grains, or actual sandstones; the former were 16·5–60 inches long and the latter 10–34·5 inches long.

The results are applicable to certain conditions only. In linear drives in uniform rocks the recovery at breakthrough may be as low as 20% of that expected without gravity effects; for 5-spot patterns the figure may by 40%. In stratified rocks the recovery at breakthrough may be affected more by permeability segregation than by gravity effects. The average injection rate rather than the daily or weekly variations in rate has most effect on the extent of gravity segregation effects, the recovery being lowest at the smallest rates, provided that capillary effects are not significant.

G. D. H.

1541. U.S. oil makes heavy going. Anon. *Petrol. Press Serv.*, 1958, **25**, 84–7.—The U.S. oil industry faces its most difficult period since pre-war days. Demand lags, and crude and refinery capacity are > ever before. Primary stocks of crude and products relative to demand are > than at any time during the last 8 years, and evidence of price weakness is growing. Well completions have been falling since 1956, and in the last week of Jan. 1958 operating rotary drills dropped temporarily to 1861, the lowest level since 1948. Even when production was stepped up to aid W. Europe during the Suez crisis, U.S. industrial production and economic activity generally were no longer expanding as hitherto. The Suez Canal reopening and cessation of U.S. emergency exports to Europe left the U.S. oil industry with expanded productive capacity but lagging domestic demand, particularly in residual fuels. The rapid advance of natural gas—produced by oil concerns—is expected to slow down long-term growth rates. Demand for gasoline is likely to be retarded by long-term influence. In face of lagging demand the reaction of

U.S. crude producers is to attack oil imports. Over the past 4 years the vol of U.S. imports of crude and products has risen by *ca* 50%, while their f.o.b. val—annual rate—has more than doubled. Continuing growth of productive capacity despite lagging demand is the direct result of the protection afforded to every producer by pro-rationing—also by tariffs on imports—now reinforced by quant import limitation. The growing costliness of much of U.S. domestic oil production has encouraged importation of less costly crudes. R. T.

1542. Well stimulation practices in the Four Corners area. R. R. Wagner and J. D. Holland. *Petrol. Engr*, 1957, **29** (13), B48–51.—Fracturing and acidizing treatments are used extensively in the Four Corners area. In the extensions of the Bisti field screen-outs have occurred during sand fracturing. Fluid loss agents were found useful in presenting screen-outs. Ball seals are often used to ensure breaking down of the formation behind the perforations. In the Paradox basin field almost all wells are fractured by acidizing, but techniques vary. Retarded acids, which penetrate deeper into the formation, are producing good results.

A. E. R.

1543. Bigger things ahead for booming Four Corners area. V. Cooper, J. L. Tatum, and H. Budd. *Petrol. Engr*, 1957, **29** (13), B21–5.—The Four Corners area, of 13,000 sq. miles, mainly in NW. New Mexico and SW. Colorado, is experiencing a petroleum production boom. Many producing areas, some prolific, have been discovered, but much exploration and testing of known structures in the region remains to be accomplished. The area has produced commercial oil and gas since 1911, but large-scale development has occurred only recently due to rugged country, inaccessible locations which cause high transport costs, and to the installation of oil and gas pipelines. Fracturing techniques suited to the conditions have proved successful. Future prospects of the Paradox and San Juan basins are considered very good. A. E. R.

1544. Flooding in South Ward. Analysis of lease performance. A. B. Dyes, P. H. Braun, and B. E. Coles. *J. Petrol. Tech.*, 1957, **9** (10), AIMME Tech. Paper No. 4650, 283–8.—The W. D. Johnson 320-acre lease of the South Ward field near the S. tip of the Yates trend is estimated to have had 34,000 brl/acre in the Bennett sand. The original pressure was *ca* 1400 p.s.i. Production, apparently by dissolved gas drive, gave 4850 brl/acre. Water flooding on a 20-acre 5-spot pattern was undertaken and the oil yield resulting was *ca* 2½ times that of the primary phase. All the low permeability section was open to injection despite its estimated poor primary yield.

It seems that the ultimate sweep-out pattern efficiency is near 100%, and *ca* 75% of the water flood oil has been obtained after breakthrough. In a layered rock cross-flow can have an appreciable effect on water flood performance, and some attempt must be made to consider this in predicting the vol of water needed to reach oil bank breakthrough and water breakthrough. Models seem to offer the best approach. For the Johnson lease it seems that cross-flow may have occurred between the 3 most permeable zones during fill-up, and there may have been 6% of free gas in the oil bank at oil bank breakthrough. G. D. H.

1545. Reservoir study of the Roosevelt pool, Utah. E. H. Rohr. *J. Petrol. Tech.*, 1957, **9** (10), 23–4.—The Roosevelt pool, with oil in the Green River formation, provided the first Tertiary production from the Uinta basin. The Duchesne, Red Wash, Flat Mesa, and Walker Hollow fields followed. The Roosevelt pool is on a broad nose with production from the lower part of the Green River formation controlled by structure, stratigraphy, and fractures. There are 2 main zones totalling *ca* 125 ft. Fractures represent *ca* 0·55% porosity, the average total porosity being 6·6%, with the permeability 0·6 mD. The reservoirs are sandstones and limestones within the oil shale and marlstone sequence, at depths of *ca* 9350 ft. The original pressure at −3960 ft was 4481 p.s.i.g., but the saturation pressure is 1800 p.s.i.g. To March 1957 the total output was 1,669,000 brl, 62% of which was from the first 2 of the 7 producers. Water output has risen to 440 b.d., the oil output being 450 b.d.

The high pour-point of the oil requires steam heating to keep a temp of 120°–130° F.

Pressure build-up periods exceed 16 days. G. D. H.

1546. Is this the answer to the Athabasca tar sand riddle? A. Gibbon. *World Oil*, 1957, **145** (7), 171.—Lab experiments have been carried out in order to determine a feasible in-place method of extracting tar from the Athabasca tar sands of Canada. These are described, and it is claimed that in scaled models it can be proved that the tar can be extracted *in situ* (without mining the sand) by means of a steam injection well pattern surrounding a producing well. The melted tar is recovered by flowing or pumping, and it is estimated that *ca* 50% of the tar in place could be recovered by this method.

Details of the model are given with diagrams and performance curves. C. A. F.

1547. Superior hits jackpot in the Lake. D. M. Taylor. *Petrol. Engr*, 1957, **29** (12), B53–6.—A lease recently exploited in the middle of Lake Maracaibo has resulted in the completion of 3 wells with at least 300 ft of producing sands each. The wells are widely spaced over the lease, and a major discovery is indicated with estimated reserves of 1000 million brl. Well tests indicate an initial production of 5000–7000 b.d. A terminal has been completed on the shore, and a 22-mile underwater pipeline from the lease to the terminal is under construction. A. E. R.

1548. Pilot water flood successful in Tucupido. S. L. Chu and E. L. Baldwin. *Petrol. Engr*, 1957, **29** (12), B43–8.—Production and reservoir pressure in a Venezuelan field had declined considerably, so a pilot water flooding project was installed. Reservoir pressure increased and production improved considerably. Channelling problems were reduced by cutting down the water injection rate. A. E. R.

1549. Hydrostatic pressure testing tubular goods in the field. C. Bendiks. *Petrol. Engr*, 1957, **29** (12), B33–6.—The quality of casing and tubing supplied in Venezuela was improved through a field pressure testing programme, which was used to avoid failures during the drilling and operation of wells due to faulty materials. A. E. R.

1550. Pilot LPG injection underway at Bisti. D. M. Taylor. *Petrol. Engr*, 1957, **29** (13), B38–44.—A miscible phase displacement recovery pilot project is underway in the Bisti field which has a solution gas drive combined with a high paraffin content which interferes with vaporization of gas in the reservoir. In addition, wide variations in permeability have made the field development barely profitable based on primary production alone. Lab experiments indicated that a water flood would be unsuccessful and that miscible phase operation would accomplish 56% recovery of the reservoir reserve. After an initial injection of LPG, *ca* 500,000 cu. ft/day of natural gas is injected and recovery is performed by 4 wells. A. E. R.

1551. Natural gas in South-West France. Problems and potentialities of the Lacq deposits. A. Blanchard. *Chem. Trade J.*, 1958, (3697), 858–60.—Production of Lacq oilfield—approx 300,000 tons p.a. in favourable years—is declining. On drilling deeper to 3500 m Lacq No. 3 erupted violently and gas smelling strongly of H_2S gushed out from the drill stems. After 2 months' work M. Kinley sealed off the well.

Further wells Lacq 1 and 2 drilled 1500 m N. and S. of Lacq 3 encountered gas. The fissuring corrosion encountered in Lacq 3—due to action of nascent H liberated by chem action of H_2S on Fe—was countered by using a special heat-treated steel. To obtain a marketable gas H_2S and CO_2 are removed and S recovered. Condensable products C_3H_8 and C_4H_{10}, and gasoline are removed. For these processes desulphurization, S-extraction, and degasolining plants are required. On the basis of data furnished by the borings executed, the deposit contains 150 milliard m³ of recoverable gas. Production—currently 1 million m³/day—of crude gas should be 20 million m³/day in 1961. The refined gas containing CH_4 and some C_2H_4 has a cal. val. ~1085 B.t.u/ft³. Priority distribution is in Government hands. The recovered gasoline —octane rating 84—contains 13% toluene and 25% xylenes, and can be used as a premium grade motor petrol, or the aromatics can be extracted profitably. The treatment factory can produce 70,000 tons S p.a., in 3–4 years it will produce 1,300,000 tons p.a. R. T.

1552. Oil in fractured and weathered basement rock of the Kriz structure. S. Galovic. *Nafta (Yugoslavia)*, 1958, **9** (1), 1–9.—On the Kriz structure, where there are at present 3 oil-producing fields, Bunjani, Sumecani, and Klostar, the basement rocks are composed of various types of granite and gneiss. The basement rocks, representing an ancient buried horst, are overlain by transgressive deposits of Neogen. In individual places the basement rocks are weathered and fractured and also sufficiently porous and permeable for becoming oil reservoir rocks. A certain number of favourably located wells, regarding both structure and facies, have been producing in each of the 3 fields. The structural and facies relations of individual areas where the basement rocks are productive are discussed and, on the basis of these relations, conclusions are drawn on elements conditioning the oil accumulation in the basement rocks of the Kriz structure.

(Author's abstract.)

OILFIELD DEVELOPMENT

1553. Mississippi lime development problems. F. M. Sanmann. *World Oil*, 1957, **145** (7), 107.—Although there has been development of the Mississippi Lime in Osage County, Oklahoma, for *ca* 2 years it is not clear whether the formation justifies individual testing and completion. Numerous shows have been recorded for the limestone in scattered wells in the area and completed wells have shown a sharp decline curve and erratic behaviour. Careful evaluation of the zone is needed, and it is claimed that, where other pays are present in a well, drainage of the Mississippi section can be justified. To date, drilling for the limestone alone is not profitable, and the better wells do not give more than a payout on investment.

The limestone, which occurs beneath the Mississippi Chat, varies from 250 to 350 ft in thickness and contains chert. Normal completion involves treatment with mud acid and fracturing. In the areas of new development porosity ranges from 4 to 8% with low permeability. A typical electric log through the section is given. C. A. F.

1554. Hopeful Alaskan operators face difficult problems. G. M. Wilson. *World Oil*, 1957, **145** (7), 82.—Alaska has good prospects for future oil production, as indicated by recent drilling, but exploration and development will be lengthy and very costly. Proper testing will require fairly deep drilling, and there will be costly outlays because of terrain and weather problems. The provision of market outlets for oil could also present difficulties.

Extensive leasing has recently taken place following the Richfield discovery, Swanson River Unit 1, on the Kenai peninsula *ca* 40 miles SW of Anchorage. This well was completed for a potential production of 900 b.d. of 33° oil from *ca* 11,200 ft.

Past and present activity in Alaska is reviewed. Present leasing is centred around the following areas: the Cook Inlet area, where a well is being drilled; the Wide Bay area, *ca* 250 miles SW. of Anchorage, where a winterized rig is drilling; the Kateel River area, E. of the Seward Peninsula; the Nushagak–Kvichak bay area; Houston, *ca* 30 miles N. of Anchorage, where a third well is being drilled; an area *ca* 100 miles NW. of Anchorage, where there are large holdings; and the Katalla–Yakutak area along the shore of the Gulf of Alaska, where several wells have been drilled. Other areas are also being investigated, and a diagram shows current oil developments in the country. C. A. F.

1555. Oil prospects in Latin America. J. Grindrod. *Petroleum, Lond.*, 1958, **21** (3), 83–7.—In 1956 S. America was responsible for 19% of the world crude oil production and was the third largest producer. Vast potential sources of petroleum are available, especially in Venezuela, Brazil, and Argentina. Venezuela is the largest producing country and has encouraged the development of resources by legislature favourable to private companies. Colombia is endeavouring to increase exploratory activity by concessions granted to the oil industry. Development of the other countries, which is being carried out largely by nationalized concerns, is on a much smaller scale. A. E. R.

TRANSPORT AND STORAGE

1556. Controlled settling of tank foundations on weak soils. J. Martinson. *Petrol. Engr*, 1957, **29** (12), C16–18.—Storage tanks have been installed on marshland without using conventional foundations such as piling. A compacted clay fill was placed 10 ft thick to underlie the tanks and extending outside the tank perimeter. The tanks were installed and gradually filled with water. Uneven settling was corrected by re-levelling, and no further correction is expected for 5 years. A considerable saving in costs resulted. A. E. R.

1557. Spherical tanks used for propane storage. G. Esnal. *Petrol. Engr*, 1957, **29** (12), C13–15.—Large liq spherical propane storage vessels were designed to hold 7000 brl at 235 p.s.i. A new alloy steel of high strength was used. The tanks were insulated with a mineral fibre layer. A. E. R.

1558. How to design an effective, low cost tank mixing device. R. B. Mery and R. B. Velykis. *Petrol. Engr*, 1957, **29** (13), C31–9.—Design data are provided for a simple and effective device for mixing crude oils and other products in fixed-roof tanks. A vertical tube with spaced suction ports is connected to an ell tube through which a small amount of tank fluid is passed by an external pump. Liq is drawn into the eductor, which is fitted with a nozzle, from all tank levels, so that recirculation of large vol is unnecessary. A. E. R.

1559. The commercial feasibility of nuclear tankers. H. Benford. *Proc. Amer. Petrol. Inst.*, 1957, **37** (5), 24–51.—The work reported in this paper was brought about by current interest in nuclear propulsion of merchant ships. While technical feasibility has been established, commercial feasibility—either present or future—remains unsettled. The purpose of this paper is to show the cost levels to which nuclear power must be reduced before it can compete on a sound economic basis with conventional power in merchant

ships. Nuclear engineers may find the information presented here useful in their various optimization studies. The net worth of savings in weight or increases in thermal efficiency —to cite 2 examples—may be realistically appraised by means of the methods outlined. The results of the studies make it appear unlikely that nuclear-propelled merchant ships will become commercially competitive within 10 years unless costs can be brought down more rapidly than now thought possible. It is found that optimum speeds for nuclear tankers will not greatly exceed optimum speeds for conventional tankers. Currently popular cost studies based on the cost per ton of cargo are shown to be ill-fitted to comparisons between nuclear and conventional ships. A return to the more basic method of comparing rates of return on investment is advocated. It is also pointed out that cost studies which simply match annual fuel savings against first cost are deceptive because nuclear power also affects most other facets of operating expense. This study is confined to the use of atomic power in tankers. It is generally agreed that a large tanker on a long ocean voyage comes close to the ideal application of commercial nuclear propulsion. Comparable calculations for other ship types would presumably yield results less favourable to nuclear power. Typical worked-out examples may be used as guides in any further studies one may wish to undertake. (Author's abstract.)

1560. Three point and pneumatic suspension of road tankers. Anon. *Fluid Handl.*, 1958, 63–4.—Increased road tanker payload for a given gross wt can be obtained by use of Al alloy tank mounted on 3-point suspension system developed by Thompson Bros (Bilston) Ltd. A pneumatic suspension system is also described. W. A. M.

1561. California line a rugged job. A. E. Garrissere. *Petrol. Engr.*, 1957, **29** (13), D19–21.—Diminishing local supplies of gas led to a 173-mile, 12-inch high pressure transmission pipeline being laid between Corning and Eureka. Rocky and treacherous terrain was encountered, and the line was located along ridge tops in mountainous areas to reduce the danger of loss due to landslides. Heavy brush and forests created fire hazards. The pipe was coated with glass fibre, felt, and layers of asphaltic enamel. A. E. R.

1562. Possible reduction of costs through use of thin wall pipe, adequate coating, and wrapping. J. C. Stirling. *Petrol. Engr.*, 1957, **29** (13), D27–32.—The loss from corrosion of a pipeline without any protection is compared with the loss from the same pipeline if it had a well-designed protective system, and the cost of the protective system is estimated. It is stated that the savings of reconditioning and labour costs on a coated line would offset the original extra cost and cathodic protection cost for several years. In addition, a lower pipe wall thickness could have been used, thus lowering investment, and the value of the pipe before reconditioning would be much greater. Soon after the completion of construction operations the pipe coating may be checked at low cost to locate and repair damage caused during construction. A. E. R.

1563. Barinas pipeline nears completion. Anon. *Petrol. Engr*, 1957, **29** (12), D22–4.—A new 20-inch pipeline 211 miles long is being built to connect the Silvestre field in the Venezuelan interior to the coast at El Palito. It is designed for a throughput of 100,000 b.d. at a max operating pressure of 1200 p.s.i. The line avoids towns and highways so that it may be laid on the surface supported by concrete blocks. For river crossings the line is buried, coated, wrapped, and cathodically protected with magnesium anodes. The pumping station is powered with 3 turbo-charged, dual-fuel engines, each developing 5000 h.p. at 1000 rev/min. A. E. R.

1564. Supervisory control of pipelines. F. V. Long. *Petrol. Engr*, 1957, **29** (12), D66–70.—Automation of pipeline operations is discussed. As the degree of automation increases, the safety precautions required also increase. Division of the system into sections avoids long communication circuits for control use, and increases the contact of personnel with equipment. The dispatch station should receive complete recorded information about the flow in the pipeline, so that operation may be efficient. A. E. R.

1565. Pipeline designed for viscous crude. R. W. Leach. *Petrol. Engr*, 1957, **29** (12), D25–7.—The selection of a pipeline to transport 48,000 b.d. of viscous crude oil from Temblador 92 miles to Caripito in Venezuela is discussed. An unheated 30-inch line was selected, although mixing water with the crude to reduce its visc was an attractive alternative possibility. A. E. R.

1566. Pneumatic control system provides engine speed control, safety shutdown. J. T. Howard. *Petrol. Engr*, 1957, **29** (13), D43–5.—A unique pneumatic system controls and automatically shuts a pipeline pumping station down if engine speed increases, lub oil pressure falls, or cooling water temp becomes excessive. The system is more durable than an electric system and is explosion-proof, cheap, and efficient. A. E. R.

1567. New gasoline rust inhibitor. R. M. Pines and J. D. Spivack. *Petrol. Engr*, 1957, **29** (12), C18–20.—Corrosion of pipelines, bulkheads of marine tankers, and storage tanks in contact with gasoline may be reduced by *N*-oleoyl sarcosine, which forms a protective film on the metal surface. This cpd is liq at room temp, readily soluble in light hydrocarbons, and ashless on ignition. A. E. R.

1568. Handling propane by pipeline. F. B. Neptune. *Proc. nat. Gas Ass. Amer.*, 36*th ann. Conv.*, 1957, 26–30.—Gas transportation by pipeline includes C_4H_{10} since 1931, and C_3H_8 since Dec. 1947. Since 1947 Phillips Petroleum Co. and Phillips Pipe Line Co. have pumped approx 17 million gal of C_3H_8 from Borger, Texas, to E. Chicago, Indiana. When pumping C_3H_8, mechanical seals were necessary. Higher pump intake pressures are required to overcome the higher C_3H_8 v.p. This, coupled with lower sp. gr., causes some loss in pipeline rates. Extreme care must be taken to provide a suitable buffer, *e.g.* C_4H_{10}, especially where scale exists, when pumping C_3H_8 and heavier products, *e.g.* stove or furnace oil. A special tariff is published for C_3H_8 transportation. The shippers are to provide storage and related facilities for handling C_3H_8 at origin and destination. A 2% loss allowance is provided for the carrier's benefit. Underground storage in caverns in salt strata, in limestone, or shale is convenient. Some storage above ground is usually needed. Additional precautions are essential when repairing leaks in presence of LPG. R. T.

1569. Richmond solves viscous oil problem at Boscán. G. Lebourgeois. *Petrol. Engr*, 1957, **29** (12), B37–42.—A very heavy viscous crude found in the Maracaibo basin field caused many production and transport difficulties. Normal drilling techniques are used, but very large pump installations are necessary to lift the crude. Large dia pipe is required from the well to the gathering station, and then the crude is heated successively on its way to the marine terminal. Heating coils are installed in tankers to keep the oil at 140° F. The refining of the crude yields a large amount of asphalt, thus developing a new source of road-building materials. A. E. R.

1570. Ethylene pipeline is completed. Anon. *Pipe Line News*, 1958, **30** (1), 46–7.—The first interstate pipeline to carry high purity ethylene has been completed from Petroleum Chemical Inc.'s plant at Lake Charles, Louisiana, to the

Orange, Texas, area. The pipeline is of 6¾ inches o.d. and will operate at 1000 p.s.i.g. The pressure in the line, which is 30 miles long, can be varied, thus permitting its use for storage of ethylene against times of special demand or to provide a regular supply during short shut-down periods at the manufacturing plant. The route was surveyed aerially; the terrain is flat, and 12 miles of it is marsh land. A description is given of the main constructional problems met, and of the plans made for operating and metering the line. These include the use of heat exchangers along the pipe to compensate for the cooling effect when ethylene pressure is reduced from 1000 to 500 p.s.i.g., at which pressure it is delivered, as otherwise the gas would liquefy. D. K. R.

1571. Isolated location adds to contractors' woes on Four Corners pipeline system. W. R. Quarles. *Pipe Line News*, 1958, **30** (1), 24–9.—Texas–New Mexico Pipe Line Co.'s new 517-mile, 16-inch pipeline system, when finished, will provide a much needed additional means of tapping the crude reserves of the San Juan and Paradox basins. Previously much of this crude had not been available at competitive prices due to the costly rail and truck transport needed from shut-in wells. Constructional difficulties due to rugged terrain and the isolated route of the pipeline are discussed, and details of the methods and work of both of the contractors, namely Four Ways Co. and Panama, Inc., are given. D. K. R.

1572. Unattended pump stations on the Evangeline System. Anon. *Pipe Line News*, 1958, **30** (1), 30–2.—A feature of Evangeline Products System's 16-inch pipeline between Port Arthur, Texas, and Baton Rouge, Louisiana, a stretch of 189 miles, is the pair of identical, fully automatic pumping stations. Each station has 3 Nordberg engine-pumping units, using 1720-h.p. Supairthermal 4-cycle engines. Details of the engines and their control from the master station on the line, with starting procedure and safeguards against stoppage of ventilation blower, low suction pressure, abnormally high discharge pressure, and leakage of products on to the floor are given. Most causes of trouble can be detected at the control panel of the master station, and this information is relayed to the service man in the trouble area. Mention is made of the construction of the stations. D. K. R.

1573. Offshore pipeline system designed for two-phase flow. T. W. Sigler and W. L. McNatt. *Petrol. Engr*, 1957, **29** (12), D46–52.—A 25-mile offshore pipeline system of 12-inches dia is designed for 31,000 b.d. of liq and 46,000,000 cu. ft/day of gas in concurrent flow. The pipe was laid in the mud on the ocean floor. Complex weighting problems were encountered as in 2-phase flow, sometimes alternate slugs of gas and liq occur, thus altering the bulk density locally. The weighting was designed to keep the pipe stationary in the mud. A. E. R.

1574. New joint design is needed in pipeline welding. L. J. Cunningham. *Oil Gas J.*, 10.3.58, **56** (10), 144.—Northern Natural Gas Co. have reported good results in field tests with a 20° bevel in pipeline welding. The line-up problems with this bevel are also discussed. G. A. C.

1575. The Trans-Arabian pipeline system. Anon. *Petrol. Times*, 14.3.58, **62** (1581), 220.—The design and operation of intermediate gas turbine pumping units for increasing throughput of a major crude oil pipeline in the Middle East are discussed, together with control system, turbine overhaul, and maintenance. G. A. C.

1576. Polyvinylidene chloride film and microcrystalline wax for protecting underground pipe. T. Kennedy, Jr. *Corrosion*, 1957, **13** (3), 186–90t.—Electrolytic corrosion is eliminated if a metal surface can be kept wet with material other than water. Microcrystalline wax is a good surface wetting agent, but it has not enough mechanical strength to stand up to all soil pressures, and therefore an external wrapper is used. Polyvinylidene chloride is found to be particularly suitable, as it is completely inert to all chemicals commonly found in soil and also to crude petroleum and gasoline. Case histories of the use of this combination in the protection of underground pipe are given. The usual thicknesses used are $\frac{1}{32}$-inch microcrystalline wax and $\frac{1}{500}$-inch polyvinylidene chloride. Further information must be gathered to prove the use of this material in the field, but results to date appear to justify continued use. F. M. G.

1577. Advances in gas pipeline technology in 1957. G. T. Kinney. *Oil Gas J.*, 10.3.58, **56** (10), 115.—A question and answer treatment is given of advances in gas pipelining during 1957. G. A. C.

1578. How to reduce surge and valve losses. C. S. Kenworthy. *Oil Gas J.*, 10.3.58, **56** (10), 170.—Modifications concerning horizontal gas engines reduced h.p. losses from piping surge and compressor valves and lowered fuel consumption by 12%. G. A. C.

1579. Cathodic protection of pipelines in soil. T. Markovic. *Nafta (Yugoslavia)*, 1958, **9** (2), 38–46.—Cathodic protection considerably reduces the maintenance expenses of underground pipelines. The principal methods for such installations are given on the basis of tests carried out both in and out of lab. It is proved that physical properties of soil play an important part in determining the quantity of the protective current. It is possible to attain a nearly complete protection of underground constructions, in proper soil conditions. (Author's abstract.)

1580. Oil transportation preferences—their bases. H. N. Emerson. *Proc. Amer. Petrol. Inst.*, 1957, **37** (5), 16–23.—This paper appraises the comparative use of marine, oil pipeline, transport truck, and railroad tank cars in bulk petroleum transportation in the U.S.A. The general factors determining the selection of transportation methods are service, safety, price, and availability. The underlying specific factors combining in various proportions to influence preference decisions relate to materials, manpower, power, fuel consumption, load factor, terminal facilities, inventories, and costs. Several tables are included to show the relative position of each transportation method. (Author's abstract.)

1581. New sea-going pipe layer. L. Resen. *Oil Gas J.*, 17.3.58, **56** (11), 180.—Brown and Root's pipe-laying barge, the *L.E. Minor* is 4500 tons gross displacement and is 350 ft × 60 ft × 22 ft deep, and was built by Levingston Shipbuilding Corpn, Orange, Texas. Description includes account of the ramp, stacker, storepipe joints, anchor winches, and welding equipment. G. A. C.

1582. The economics of liquefaction, storage, and transportation of natural gas. P. B. Lederman and B. Williams. *Proc. nat. Gas Ass. Amer., 36th ann. Conv.*, 1957, 42–9.—Transportation of natural gas from major sources—the U.S. Gulf Coastal area, Venezuela, and the Persian Gulf—is impractical. Liquefaction—with a 600-fold vol reduction/heating unit—appears to solve the problem. In examining the economics of the liquefaction process costs can be broken down into 3 major categories: liquefaction—mainly dependent on compressor requirements—and transportation and storage, both of which are functions of distance from source to market, and eff of tanker and land storage utilization. In order to obtain an economic perspective, various liquefaction capacities and typical cycles, *i.e.* refrigeration schemes and factors which influence shipping and storage, are ex-

amined. Presence of C_3H_4 and heavier components permits liquefaction at higher temp; He and N have the opposite effect. The C_3H_8–C_2H_4–CH_4 cycle and the Claude cycle are discussed with flow diagrams. CO_2, aromatics, and H_2S may cause difficulties at low temp. Liquefaction of natural gas for transportation and storage is feasible economically, and should be competitive with most fuel sources for a long time. 31 refs. R. T.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

1583. Economics of gas turbine drivers in the refinery. C. R. Apitz. *Petrol. Engr*, 1957, **29** (13), C11–14.—Applications of industrial gas turbines include driving pumps, compressors, and generators, and generating hot gas for cat regeneration. The gas turbine is economical to install, operate, and maintain, and is reliable for long periods of continuous operation. Besides the shaft power, additional recoverable heat energy is produced in the form of exhaust gas of high oxygen content and temp, which may be burnt in a boiler furnace or passed through a waste heat boiler. A. E. R.

1584. Automation in refinery product blending. Pt 3. L. Lowy. *Petrol. Engr*, 1957, **29** (13), C50–62.—The continuous blending of fuel oils and asphalts is described. A method is given for the determination of the proportions of the products to make a desired blend. The continuous blending of asphalts offers a wider range of grades without excessive tankage requirements. A. E. R.

1585. Automation in natural gasoline plants. A. R. Wagner. *Proc. nat. Gas Ass. Amer.*, 36*th ann. Conv.*, 1957, 10–12.—Instances of early automation are steam governors devised in 1881, recorder controllers used in the 1920s, and miniature panel-mounted pneumatic instruments developed in the 1940s. Developments in the electronic field have provided a vast array of equipment utilizable in the petroleum industry. Electronic level sensing probes in tank gauging, electronic and pneumatic control for process streams, and electronic automatic systems for scanning temp and other variables, and for logging these val are used. Continuous analysis devices and methods to supplement the pneumatic and electronic controller, *e.g.* mass spectrometry, refractometry, chromatography, radiology, and v.p. are being developed. Newer type steam plants are well equipped with instrumentation. R. T.

1586. Continuous analysis and control of process streams. F. W. Karasek. *Proc. nat. Gas Ass. Amer.*, 36*th ann. Conv.*, 1957, 12–17.—Process instrumentation has advanced from almost exclusive use of simple instruments to measure temp, pressure, and flow, to include the more versatile and complicated composition measuring instruments, *e.g.* the refractometer, u.v. analyser, and i.r. analyser. Nearly every continuous plant analyser, *e.g.* stream analyser, etc., has been derived from a lab technique. Although *n* provides a nonselective method of measurement, differential refractometers have been used widely to control the separation of extremely narrow boiling range fractions of pentanes, hexanes, and heptanes in natural gasoline streams. The i.r. analysers provide material balance information, analytical information for manual control, and also provide an alarm in case of equipment malfunction or dangerous operating conditions. The mass spectrometer—although not explosion-proof—is successful in control of S recovery, ammonia synthesis plants, oil drilling operations, pilot plant, and process studies. The electrolytic H_2O analyser is valuable in measuring H_2O in p.p.m. in hydrocarbon streams. Gas chromatography instruments possess capabilities found in both the i.r. analyser and mass spectrometer. 8 refs. R. T.

1587. Case histories of several gas products plants. E. J. Mills and L. L. Buck. *Proc. nat. Gas Ass. Amer.*, 36*th ann. Conv.*, 1957, 23–5.—4 plants—3 gas products plants and one cycling plant—operated by Sunray Mid-Continent Oil Co.—are described with supporting flow diagrams. In each case absorption pressure is set by the pressure required on the residue gas. Other conditions vary widely. Mol. wt. of the oil ranges from min 140 to max 212. Absorption temp, *i.e.* average temp in the absorption section of the column, varies from 2·5° to 110°. Lean oil temp varies from −10° to 90° F; absorber pressure varies from 500 to 2040 p.s.i.g., and actual C_3H_8 recovery varies from 65 to 82%. Operating variables for the 4 plants are tabulated. R. T.

1588. Economics of nitrogen removal. J. G. Burnham. *Proc. nat. Gas Ass. Amer.*, 36*th ann. Conv.*, 1957, 50–2.—In the past 8 years 3 actual plants—not one has been built to date—have been designed using engineering and estimating based on accumulated information. The 3 plants were designed and estimated using refrigeration for liquefying the gas at temp ranging from −150° to −210° F, and fractionation for separating N from CH_4. The 3 plant designs were for major pipeline transmission companies in Kansas, Oklahoma, and New Mexico. The raw gas cont varied from 16 to 27% N, and had a cal. val. from 700 to 900 B.t.u. Pertinent information of gas vol, % N extracted, upgrading of cal. val., investment, and daily income and expenses is tabulated. Although the economic return from an N-removal plant is likely to be poor, advantages may exist. All the liq hydrocarbons can be recovered as saleable product. The residue gas is upgraded in cal. val. More ft^3 of gas may be transmitted through the same pipeline with the same pressure drop. R. T.

1589. Modern procedure for mineral oil processing. (In German.) E. Willig. *Erdöl u. Kohle*, 1957, **10**, 20–4.—The increasing energy gap which coal cannot cover must be covered by fuel oil. O.N. improvement and increased C.R. of motors, implying better utilization of power fuel, are discussed. Characteristic dist processes developed in recent years—predominantly in the U.S.A.—give a general review of the problems and process development—with flow diagrams—for converting available crude oil into valuable products. R. T.

1590. How to design finned tube shell and tube heat exchangers. Pt 2. E. H. Young and D. J. Ward. *Petrol. Engr*, 1957, **29** (12), C32–6.—Equations for the design of finned tube condensers for hydrocarbons and other organic liq are given. A worked example of the selection and sizing of a condenser is provided. A. E. R.

1591. Materials of construction reviews. Nickel and nickel alloys. R. M. Fuller. *Industr. Engng Chem.*, 1957, **49** (9), Pt 2, 1618–28.—Mention is made of the use of nickel, Monel, Inconel, the Hastalloys, stainless steels, 70–30 cupronickel, and Ni-resist in the petroleum industry for constructional purposes. Items using these materials include caustic soda regenerators, piping, pumps and valves, heat exchanger equipment, cat cracking units, storage tanks, etc. Monel, particularly, is used where salt water corrosion would occur, as in offshore drilling platforms. 60 refs. D. K. R.

1592. Variations in refinery installation costs. G. Pastonesi and A. Morpurgo. *Riv. Combust.*, 1958, **12** (3), 175–86.—A broad indicative analysis is made of the fixed costs which a petroleum refinery has to bear. The main items appearing under investments are reviewed in the light of published data and direct experience. Diagrams are shown, plotted from these mean figures, with particular regard to the Italian situation and only for refineries comprising topping, cat reforming, and chemical processing plants, as well as the primary facilities ancillary thereto, covering the following data: (1) total and specific investment; (2) total and specific fixed costs; (3) charge in specific fixed costs in case of incomplete utilization of processing capacity. Some comment is made on the incidence of labour, losses, and consumption on processing costs. (Authors' summary.)

1593. NPSH and centrifugal pumps for pipelines. V. Lobanoff. *Oil Gas J.*, 24.2.58, **56** (8), 121.—The 14 variables which affect static lead above vapour pressure (net positive suction head) are discussed, and steps taken by pump manufacturers and users to lower the required values are outlined. G. A. C.

1594. Tables speed cooling tower calculations. M. Brooke. *Petrol. Engr*, 1957, **29** (12), C23–6.—Examples of cooling tower calculations are given illustrating the use of enthalpy and humidity tables of moist saturated air. A. E. R.

1595. Hydraulic jet cleans topping unit condensers. L. E. West. *Petrol. Engr*, 1957, **29** (12), C60.—Water at high pressure from several orifices fixed to a lance dislodges deposits from condensers and also propels the equipment forward so that little effort is required to guide the lance through the tubes. This method is claimed to be more economical than the sand blasting method. A. E. R.

1596. How to calculate adequate spring-loaded relief valves. J. E. Bigham. *Chem. Engng*, 1958, **65** (3), 133–6.—The factors to be considered in choosing a relief valve are enumerated, and capacity formulæ are given to enable calculation of valve area. The installation of relief devices and design of discharge lines are also considered. P. J. O.

DISTILLATION

1597. Find distillation stages graphically. P. J. Horvath and R. F. Schubert. *Chem. Engng*, 1958, **65** (3), 129–32.—An extension of the McCabe–Thiele method to very high and very low product concn is described. To avoid pinching at the ends of the plot, the x–y data are replotted on log–log coordinates, which gives considerably increased accuracy but keeps the calculation simple. P. J. O.

1598. Horizontal fractionator looms as potential rival to multi-plate high-vacuum tower. C. S. Cronan. *Chem. Engng*, 1958, **65** (3), 76–8.—A new fractionator is described, capable of handling 1000–10,000 lb/hr of oil feed with a pressure drop of only 5 mm of mercury. A horizontal platen heated with Dowtherm is used, along which the feed flows as a thin film. Vapour formed is immediately condensed on a cooled surface above the platen, and allowed to fall back as liq. By supplying feed to a point near the middle of the platen and removing vapour from each end, a fractionation is thus effected. The first application of the method has been as a 1250-lb/hr tall oil fractionator producing resin and fatty acids; because of the low pressure drop no steam was necessary, which meant lower corrosion rates and smaller capital costs due to the reduced size of the equipment. P. J. O.

1599. New method for design of multi-component distillation towers. R. J. Hengstebeck. *Petrol. Engr*, 1957, **29** (12), C6–12.—Reduction of a multi-component system to a binary system of key components is used to solve a dist problem with the minimum of trial and error. The optimum feed tray is located, and a reasonable reflux rate is selected without requiring a determination of the minimum reflux rate. The method may be used for single- and dual-feed towers, with or without a sidestream. A. E. R.

1600. Electrical treating of refinery distillates. R. W. Stengel. *Petrol. Engr*, 1957, **29** (13), C15–17.—The stability of the emulsions produced by chemical treatment of refinery dist varies according to the nature of treatment and other factors. Electrical treating processes are used to obtain almost complete phase separation of emulsions of many refinery streams. Equipment costs are moderate and electrical power requirements very small. A. E. R.

SOLVENT EXTRACTION AND DEWAXING

1601. Plate extractors for countercurrent distribution of easily emulsified pairs of liquids. (In German.) E. Jantzen and G. Kippel. *Chem. Ing. Tech.*, 1958, **30**, 121–5.—Liquids which show a marked tendency to emulsify can be contacted, if the 2 phases are not allowed to mix. Signer plate extractors, working on this principle, are quite efficient, but have a low throughput. Experiments are described with an apparatus of this type, modified to give a much higher throughput, using a system benzene–acetone–water. The construction of a lab scale column is described. P. J. K.

1602. Small change nets wax process dividends. T. P. Forbath. *Chem. Engng*, 1958, **65** (3), 116–19.—The world's largest wax plant, at Bayonne, New Jersey, is described following recent modernization; this included modification of the solvent recovery furnace to increase capacity 11%, and application of control systems to filter cloth washing and depressurization of scraped-surface heat exchangers. P. J. O.

1603. Research on de-waxing in acetone–benzene and di-chloroethane–benzene. Anon. *Bull. (Polish) Inst. Petrol.*, 1957, **7**, 7–8 (suppl. to *Nafta (Krakow)*, 1957, **13**).—This work was preliminary to anticipated industrial work and was done in order to obtain the required degree of crystallization and other conditions according satisfactorily with the nature of the oils to be refined. Acetone–benzene mixture has proved to be the better solvent. M. S.

CRACKING

1604. Effect of oilfield use of chlorinated solvents on catalytic reforming. J. A. Guthrie and P. S. Hepp. *Petrol. Engr*, 1957, **29** (13), C40–4.—The use of chlorinated solvents in oilfields to control paraffin deposition in pipelines has led to serious cat deactivation and equipment corrosion in cat reformers, due to the similarity in b.p. between the reforming charge and the solvents. Yields are decreased due to coking resulting from excessive cracking and cat deactivation. Conventional treating methods are ineffective in recovering the chlorinated cpds. The reformer products containing HCl may cause serious corrosion in a variety of equipment. A. E. R.

HYDROGENATION

1605. Unit operations reviews. Hydrogenation and hydrogenolysis. J. T. Bradbury. *Industr. Engng Chem.*, 1957, **49** (9), Pt 2, 1523–31.—The subjects covered include the hydrogenation of carbon oxides, oils and fats, acetylenes, olefins and aromatic hydrocarbons, petroleum, coal and re-

lated materials, and hydrogenation of organic cpds. Also the OXO synthesis, ammonia synthesis, and fundamental studies of hydrogenation cat. The review is done in tabular form under these headings, with a brief note on each and a list of the relevant literature. 211 refs. D. K. R.

1606. Making butadiene. 5. Feed preparation and finishing. J. C. Reidel. *Oil Gas J.*, 23.12.57, **55** (51), 74.—In this concluding section the use of furfural extractive dist is reviewed when butylene is the feedstock, and also when butane is the chore. The C_4 separation processes in commercial use are summarized, and employment of u.v. and i.r. analysers-controllers in furfural processing discussed. Flow diagrams are given. G. A. C.

1607. Hydrogenation of aromatic hydrocarbons in oil derivatives. D. Vranjican, B. Prohaska, and Z. Tartaro. *Nafta (Yugoslavia)*, 1958, **9** (2), 33–8.—This study deals with use of Raney-Ni as a cat for quantitative hydrogenation of heavier petroleum fractions, in order to accomplish " direct method " of structural group analyses. In a series of experiments the optimal conditions of the use of Raney-Ni are established. Results show that Raney-Ni is a very useful cat for quantitative hydrogenation of petroleum fractions.

(Authors' abstract.)

ALKYLATION

1608. Unit operations reviews. Alkylation. L. F. Albright and R. N. Shreve. *Industr. Engng Chem.*, 1957, **49** (9), Pt 2, 1459–67.—More alkylate is being used for producing high grade motor fuels (to balance the high octane fuels produced by cat reforming and cracking), than for making aviation fuels. Brief mention is made of many alkylation processes. 260 refs. D. K. R.

ISOMERIZATION

1609. The ISO-KEL process for pentane isomerization. H. G. McGrath. *Proc. nat. Gas Ass. Amer.*, 36*th ann. Conv.*, 1957, 68–71.—Changes in automotive design have required—and will continue to require—increasingly higher octanes. More premium gasoline will be needed. To-day the average O.N. of premium gasoline is 97·5 and of regular 90·5 research. Aromatics improve gasoline performance, their lead response is inferior to that of *iso*paraffins but superior to that of olefins. The greatest factor in the rise in O.N. of gasoline in recent years has been the almost universal use of cat reforming processes. *iso*Paraffins—the best-known example is alkylate—particularly butylene–*iso*butane, are used largely. Isomerization is another process for synthesizing *iso*paraffins, *e.g. iso*pentane. The M. W. Kellogg Co. has developed a new method for isomerizing pentane; the product has an octane rating equiv to alkylate. The process is a vapour-phase operation under H_2 pressure, requiring only one reactor. Normal pentane can be isomerized to *ca* 65% conversion per pass. The cat—a precious metal not Pt—has superior selectivity, operates at a lower temp than conventional cat, and only a small quantity is required. The process is described with a flow diagram. *iso*Pentane yield from *n*-pentane is approx 100%. R. T.

1610. Hydroisomerization of paraffin wax. F. Breimer, H. I. Waterman, and A. B. R. Weber. *J. Inst. Petrol.*, 1957, **43** (407), 297–306.—After a brief review of the literature on the isomerization of paraffin wax to low pour point lub oils of high V.I. and diesel fuels of good cetane number, experiments carried out to determine the effect of various cat on the course of the reaction and on product yields are described. Paraffin wax was vaporized with hydrogen and contacted with various cat. The reaction products are treated as *pseudo* 3-component systems, and an equation relating the concn of each of the products is used to determine the effect of reaction variables, with special attention to optimum cat selection. 11 refs. C. B.

1611. Processing of natural gasoline components by Penex and Platforming. R. E. Sutherland and D. H. Belden. *Proc. nat. Gas Ass. Amer.*, 36*th ann. Conv.*, 1957, 75–80.—A discussion on O.N. and desirable characteristics of motor fuels, particularly the effect of volatility on performance during the warm-up period, is presented. Universal Oil Products Co.'s most recent process for isomerization of light paraffinic hydrocarbons is the Universal Penex process. This process permits production from low-quality paraffins, by isomerization, of highly-branched paraffins with characteristics similar to alkylate, as regards enhancement of road ratings. By applying Platforming and Penex, significant improvements in O.N. of products marketed by gasoline manufacturers are possible. 2 cases are presented and described with flow diagrams, both having in common Platforming of C_7 + virgin naphtha, one having Penex processing also. Depending solely on cat reforming for upgrading the pool, a ceiling is reached at *ca* 95·5 leaded O.N. Using Penex and Platforming, no plateau is evident. It is stated that Penex and Platforming of natural gasoline fractions can solve economically the octane problem for natural gasolines. R. T.

1612. Octanes for to-day and to-morrow. J. A. Nevison, H. H. Zachow, and D. C. Benedict. *Proc. nat. Gas Ass. Amer.*, 36*th ann. Conv.*, 1957, 71–4.—The petroleum industry faces the combined effects of need for higher octanes, namely, downward valuation of natural gasoline relative to finished gasoline, or installation of costly processing equipment. Catforming produces some improvement in octane val of pentanes and hexanes present in the charge. However, greater improvement is obtainable by using more selective cat under special operating conditions. The Pentafining process developed by Atlantic Refinery Co.—flow diagram presented—employs a cat with excellent isomerization selectivity. A comparative economic study illustrates how Catforming and Pentafining will upgrade natural gasoline. Facilities for Pentafining would permit complete conversion of *n*-pentane to *iso*pentane and processing of hexanes on a once-through basis. The products would be a 95% *iso*pentane stream with a research blending val of 103 at 3 cc TEL, and a high quality hexane stream. By combining Catforming with Pentafining the natural gasoline producer—by a simple, economic, and efficient process—can retain market flexibility in future octane markets. R. T.

1613. Unit operations review. Isomerization. S. F. Perry. *Industr. Engng Chem.*, 1957, **49** (9), Pt 2, 1532–3.—Serious attention is now being given to the isomerization of *n*-pentane and *n*-hexane as a means of improving O.N. 4 new processes are available for hexane isomerism, *i.e.* Pentafining and the Penex, Isomerate, and Iso-Kel processes. None of these use aluminium chloride as cat, and all work at higher temp than the Isomate process, using dual function cat (isomerization and hydrogenation activity) with recycle hydrogen. Brief notes on the 4 processes are given; all 4 appear to give comparable results. Mention is made of butane isomerism, which is still in limited use. 25 refs. D. K. R.

CHEMICAL AND PHYSICAL REFINING

1614. Unit operations reviews. Decomposition of hydrocarbons. C. V. Berger and H. R. Appell. *Industr. Engng Chem.*, 1957, **49** (9), Pt 2, 1478–84.—The theoretical and industrial advances achieved in the last few years in the

thermal and cat decomposition of hydrocarbons are reviewed, and mention is made of work done by several firms on cracking hydrocarbons by high energy radiations. The impact of platinum cat reforming on the refining of oils is evident in the fact that the capacity for reforming by this method has increased by 250% p.a. for the last 7 years, and now forms 90% of reforming capacity. Cat cracking as a whole has increased 7% on 1956, and research into the nature of active centres is described which indicates that these are Brønsted acids. In the thermal field the greatest commercial activity has been in severe thermal cracking, producing olefins, particularly ethylene, for chemical production. Significant experimental advances in the thermal cracking of high mol. wt. hydrocarbons with regard to the coke formation are mentioned. Some of the work on irradiation of hydrocarbons with high energy beams indicates that ion-molecule reactions, and not free radicals, may be a major mode of reaction under these conditions. The effect of sulphur, and of other factors, on the cat life in reforming operations is discussed. Industrial progress in this field is briefly reviewed. 64 refs. D. K. R.

1615. Unit operations reviews. Sulphonation and sulphation. E. E. Gilbert and E. P. Jones. *Industr. Engng Chem.*, 1957, **49** (9), Pt 2, 1553–9.—References are made to articles on the mechanism of benzene sulphonation by aq sulphuric acid, the direct treatment of monocyclic materials with cpds of sulphur trioxide, and the production, properties, and uses of petroleum sulphonates. Developments in sulphonating agents are mentioned. 158 refs. D. K. R.

SPECIAL PROCESSES

1616. Economic factors dictate shutdown or world's first gas synthesis plant. Anon. *Petrol. Engr*, 1957, **29** (12), C56–8.—A plant designed to produce gasoline, other petroleum products, and chemicals from natural gas was unsuccessful due to excessive costs. Difficult problems of poor filter operation and low gas–solids contact efficiency in the reactor were solved, and the process is now technically operable and economically feasible, depending on the scale of operation and the cost of labour, materials, and products. A. E. R.

1617. Unit operations reviews. Hydration and hydrolysis. W. F. Hamner and D. W. McDonald. *Industr. Engng Chem.*, 1957, **49** (9), Pt 2, 1518–22.—The main interest in this field is in the production of alcohols, glycols, nitriles, amides, and silicons. Large capacity increases, especially in synthetic alcohols, ethylene oxides, and glycols, have been announced. U.S. production of synthetic alcohol is 243 million gal p.a., and Shell have announced a new *iso*propyl-alcohol plant to produce 120 million lb p.a., of which 50 million is said to be for acetone production. Direct hydration of ethylene is becoming more favoured than the sulphuric acid process for producing ethyl alcohol, and a new type of reactor using alternate cat beds and liq–vapour contacting zones is claimed to give greater conversion of propylene to *iso*propyl-alcohol. Advances in the hydration of acetylene and allied cpds are mentioned. Some details of the expansion in glycol production are given, and a direct oxidn process for the production of ethylene glycol from ethylene oxide is commented on. The production of phenols, nitriles and amides, and organic silicon cpds is also reviewed. D. K. R.

METERING AND CONTROL

1618. New trends in the instrumentation of refinery processes. S. W. J. Wallis and D. S. Townend. *J. Inst. Petrol.*, 1958, **44** (410), 29–40.—The development of automatic control is described, and it is stressed that a new approach is required to overcome shortcomings inherent in modern methods. These are due to several facts, namely, that control of product quality is indirect, that faithful performance is required from each individual control loop, that automatic correlation between control loops is impossible, that sampling and testing introduces long time delays, and that the operator is required to assimilate and evaluate information from a large number of variables. It is suggested that consideration of the process plant and its control as an entity, and as a unit in a complex economic system, will lead to control systems maintaining the plant at optimum conditions. The use of automatic data logging, quality analysers, electronic control systems, presentation of information, and integration of process plants using computer techniques is described. 14 refs, 4 pages of discussion. C. B.

1619. Two meter-proving methods. M. L. Barrett. *Oil Gas J.*, 24.2.58, **56** (8), 153.—Gravimetric and volumetric proving of flowmeters are discussed. The gravimetric system is best for permanent installations; volumetric proving involves comparison of 2 meters. G. A. C.

PRODUCTS

CHEMISTRY AND PHYSICS

1620. Predict mixture heat of vaporization. W. R. Gambill. *Chem. Engng*, 1958, **65** (3), 137–40.—The heat of vaporization of a mixture can be estimated in various ways when there is insufficient data available. Simple and rigorous methods are discussed, with notes on the treatment of petroleum oils according to Cragoe, Maxwell, and Hougen and Watson. P. J. O.

1621. Film tells flame temperature. C. S. Cronan. *Chem. Engng*, 1958, **65** (2), 64–6.—A new method developed in rocket research photographs 4 standard lamps at the same time as the flame whose temp is to be measured, thus providing built-in calibration and eliminating film processing variables. Method is claimed accurate within 10° in 1000°–2000° C range, using double path method, for homogeneous flames only. P. J. O.

1622. Application of a colloid mill in the reaction between linear hydrocarbons and urea. M. Panetti. *Riv. Combust.*, 1958, **12** (3), 187–95.—The article sets forth the results achieved with the use of a colloid mill in the reaction between linear hydrocarbons and urea for the extraction of paraffins from various types of petrolatum. Operating conditions for both non-continuous and continuous cycles are described, and the conclusion reached that the continuous cycle integrated by particular expedients enables the mill to be very well exploited and is accompanied by high yield. The enormous reduction in reagents contact time, and hence in the size of the equipment required to stir them, are the advantages obtainable with the use of the colloid mill, as compared with conventional methods of stirring. (Author's summary.)

1623. Selectivity in chemical reactions. H. I. Waterman and A. B. R. Weber. *J. Inst. Petrol.*, 1957, **43** (408), 315–22.—After a discussion of the importance of functions to predict the concn of components in a reaction, and a description of the reactions simultaneously involved, consecutive, side, and parallel, the author outlines a graphical method of using the

functions to determine the effect on reaction products of reaction variables, *i.e.* cat, time, etc. Complex reactions are considered as *pseudo* 3-component systems. The method is applied to published data on various reactions. 11 refs.
C. B.

1624. Column packings for gas chromatography. D. H. Desty. *Nature, Lond.*, 1958, **181**, 604.—Report of the Gas Chromatography Discussion Group (IP), Cambridge, Oct. 1957.

The first paper considered the factors contributing to peak broadening, and discussed the effects on column efficiency of gas velocity, sample size, support particle size, and proportion of stationary phase. The second paper described experiments on column efficiency using a hydrogen flame detector with H_2/N_2 (3/1) as carrier gas, and a stationary phase of Apiezon oil A with insulated brick support. The third paper dealt with the use of copper and zinc stearate and nickel oleate as column liq. With hydrocarbons the results were similar to those using conventional stationary phases, but with for example, amines, steric factors markedly affected the separations. Thus, 2,6-lutidene, α-, β-, and γ- picolines could be separated. The fourth paper put forward recommendations on the presentation of retention data; either as a linear equation relating the chosen parameter to temp, or data at at least 2 temp with the partition coeff of the standard solute.

A description of a flame detector based on ionization currents developed between the jet and a positive Pt-gauze electrode inserted in the flame was given. A sensitivity of one part in 4×10^8 was claimed. H. C. E.

1625. Research into " contact " treating of oils with decolorizing earths. A. Ablamowicz. *Bull. Polish Inst. Petrol.*, 1957, **7**, 7 (suppl. to *Nafta (Krakow)*, 1957, **13**).—Research at the Polish Petrol. Inst. has shown that treatment of partly refined oils is more effective and more economic than treatment of only slightly refined oils. Improvements for a certain group of oils are listed. M. S.

ANALYSIS AND TESTING

1626. Modern trends in petroleum analysis. H. Powell and W. H. Thomas. *J. Inst. Petrol.*, 1958, **44** (410), 19–28.—Recent advances in methods of analysis and instruments are described. They include microchemical methods, chemical methods, i.r., Raman, u.v., mass, nuclear magnetic resonance, and emission spectroscopy, and the use of flame photometry, X-rays, light scattering, polarography, and titrimetry. Automatic methods and monitoring are considered, and mention is made of chromatography, thermal diffusion, electron microscopy, and viscometry. The use of statistics and digital computers is briefly described. 52 refs. C. B.

1627. Test methods for petroleum products and intermediates. Pt 1. V. A. Kalichevsky. *Petrol. Engr*, 1957, **29** (13), C25–30.—Methods for the determination of density and sp. gr. of petroleum products are reviewed. Relationship of density with other properties is presented; however, density alone is of little value for estimating performance characteristics of petroleum products. A. E. R.

1628. Electron microscope as an analytical tool. W. H. Carls. *Petrol. Engr*, 1957, **29** (12), C20–2.—Formation and accumulation of sludge in residual and dist oils cause difficulties when used in diesel engines. Fuel oil additives are necessary to inhibit sludge formation. The electron microscope permits easy evaluation of the effect of additives which break up larger particles formed by ageing. A. E. R.

1629. Two-phase concurrent flow of liquids and air through inclined pipe. W. E. Brigham, E. D. Holstein, and R. L. Huntington. *Petrol. Engr*, 1957, **29** (12), D39–42.—Lab tests on liq–gas flow through transparent pipes were made to investigate the effect of up- and down-hill flow on pressure drop and to provide pipeline design data. Pressure drops were found to increase with air velocity and to a lesser extent with oil velocity. In practice, pressure drop may be markedly increased by liq accumulations in valleys at low operating flow rates. A. E. R.

1630. Resolution in gas–liquid chromatography. D. Brennan and C. Kemball. *J. Inst. Petrol.*, 1958, **44** (409), 14–17.—Experiments carried out to determine the effect of the various factors on the resolution are described. The equation of van Deemter *et al* for HEPT of a column has been tested for different flow rates, pressures, and column lengths and found satisfactory. A simple function defining resolution is proposed. It varies linearly with column length, and so may be used to assess the minimum column length required to achieve a given separation. 8 refs. C. B.

1631. Paper chromatography of polycyclic tar hydrocarbons. E. Malý. *Nature, Lond.*, 1958, **181**, 698.—These cpds can be separated by ascending chromatography on filter paper impregnated with paraffin oil (medicinal white oil), using oil-saturated methanol as the mobile phase. The spots are located by fluorescence in u.v. light. H. C. E.

1632. Flame ionization detector for gas chromatography. J. Hanley, W. Nel, and V. Pretorius. *Nature, Lond.*, 1958, **181**, 177.—This detector depends upon the ionization of the gas effluent in a hydrogen flame. In the apparatus as described, a full-scale deflection was obtained with an injected sample of 1 μl, and the electrical output appeared to depend linearly on the sample size. H. C. E.

CRUDE OIL

1633. Selected crude evaluation charts. Anon. *Oil Gas J.*, 24.3.58, **56** (12), 109.—Charts, tables, and data for 47 crudes are given, the crudes representative of tanker or pipeline mixes or from prolific fields. Crudes include 20 American, 4 Canadian, 9 Venezuelan, 8 Middle East, 2 European, one African, and 3 from the Far East. G. A. C.

1634. Relative value of crude in refining operations. N. R. Adams and R. C. Kersten. *Oil Gas J.*, 24.2.58, **56** (8), 125.—Evaluating a crude for refining purposes on the basis of API gravity alone is unsatisfactory, an engineering study being as necessary for the evaluation as it is in determining the optimum processing operation. Tables show yield comparison of crude oils from producing areas and estimated net operating profits. G. A. C.

1635. Processing Cortemaggiore crude oil with urea. Pt III. M. Panetti and R. Gay. *Riv. Combust.*, 1957, **11** (12), 797–810.—An analysis was made, by the *n–d–M* method and by Leithe's *n*-paraffin assay, of the various fractions obtained by vacuum column dist of the product obtained when processing Cortemaggiore crude oil with urea. The results are shown in tables and graphs. The experimental data were used to determine the structural composition of the individual fractions (aromatic, naphthene, *iso*paraffin, and paraffin) and to corroborate by simple computation the suggestion put forward in a previous note concerning the arrest in adduct formation reaction. (Authors' summary.)

GAS

1636. Big strides by liquid gas. Anon. *Petrol. Press Serv.*, 1958, **25**, 92–5.—Of over 700 million tons p.a. of petroleum products currently consumed in the free world, over 16½

million tons are marketed as LPG, a highly-conc thermal energy form, with cal. val. 2700–3400 B.t.u/ft³. LPG is used in pressurized form in cyl to fulfil the domestic functions of piped gas, from cooking and lighting to water- and space-heating, air conditioning, and refrigeration. Universal post-war expansion of natural gas and oil refining operations has developed LPG trade outside the N. American continent. It has become the fastest growing branch of business in the oil and natural gas industries' manifold activities. Free world sales of butane and propane extend over *ca* 70 countries. The U.S.A., where liq gas is produced more cheaply, and used as domestic, industrial, and motor fuel, and a chem raw material, accounts for 85% of the total. *Ca* 30% of the total marketed supplies in the U.S.A. provides raw material for production of plastics, synthetic rubbers, etc. Large quantities are used in polymerization processes, gasoline blending, solvent dewaxing, etc. In the U.S.A. its use as a motor fuel in agriculture and road transport is notable. With O.N. *ca* 100 it can be used in high-compression engines. Dominant features of the economics of transportation, use, and storage of LPG throughout the free world are discussed. New types of refrigerated LPG carriers are under consideration for bulk transport of liq gas from W. or Middle East sources to Europe. R. T.

1637. Fuel gas for Venezuela's progress. M. A. Romero. *Petrol. Engr*, 1957, **29** (12), D32–8.—Gathering operations set up in remote Venezuelan oilfields collect natural gas which is used to supply industries and cities. 2 systems operating at 250 and 1000 p.s.i. are used, and the gas is compressed by packaged, skid-mounted, battery compressors. A. E. R.

1638. Low temperature separations. B. J. Ferro. *Proc. nat. Gas Ass. Amer., 36th ann. Conv.*, 1957, 52–7.—Growing demands for increased supplies of natural gas components can be satisfied only by increasing application of low-temp processing techniques. Development of a continuous air separation process in 1895 constituted a guide for adaptation to other ow-temp processing cycles. Prime considerations in a low-temp separation plant are: pre-purification—removal of H_2O and impurities—of plant feed; cold production by compression and expansion, which must be held to an economic minimum; proper selection of materials for severe conditions; rigid inspection. Brief descriptions are given of low-temp separation processes with flow diagrams of present and future importance to continuing expansion of oil, natural gas, and chem industries. These include O_2, N, and A separation from air, and He and N removal from natural gas. High-purity CH_4 is obtained by low-temp processing. R. T.

1639. Utilization of natural gas for domestic use. I. Giordano. *Riv. Combust.*, 1958, **12** (1), 20–43.—After reviewing the status of the town gas industry following the introduction of natural gas, the article points to the difficulties arising from growing winter peak consumption caused by indiscriminate withdrawal of the natural gas required to meet the public utility demand, and stresses the principle that the solution lies in making available to users all the gas fuel required for this purpose. To this end a solution is suggested based on a reasonable predetermined value of the annual utilization coeff of natural gas supplies in connexion with a max daily uptake varying with the increased consumption. The utility companies would then have to handle the problem of fully meeting the consumption demand with addition of technical gases or LPG to the natural gases available. This solution, according to the above principles, should prove technically and economically achievable for the utility companies in question.

(Author's summary.)

1640. Problems and prospects of the domestic use of natural gas. D. Ciuffolotti. *Riv. Combust.*, 1958, **12** (1), 5–19.—A general picture is given of the current situation concerning the use of methane in household appliances, showing that in 1956 methane covered 54·6% of the calories supplied as gas by the different town supply systems. An appraisal is given of the economic benefits to the general consumer by the supply of methane, computing a total figure of over 10 milliard lire. Consideration is given from the technical and economic standpoint to the various measures which can be taken to overcome the difficulties ensuing from further development of the household use of methane, pointing to integration with propane as a suitable means of achieving the purpose.

(Author's summary.)

1641. Liquefied natural gas. C. I. Kelly. *Petrol. Times*, 28.2.58, **62** (1580), 178; 14.3.58, **62** (1581), 215; 28.3.58, **62** (1582), 266.—Pt III. The performance is reviewed of storage vessels built and in use. Success or failure depends on adequate design, choice of suitable metals of construction, the type of heat-insulant chosen, prudent disposition of units, and local conditions. Vessels described include the Cornwell pilot-plant, the Cleveland Unit's vessels, including in some detail the No. 4 Toro-segmental cyl tank which failed and possible reasons, and the Moscow Unit's vessels.

Pt IV. The design of storage vessels for the proposed Chicago plant are discussed. (These tanks were not built.) The need for a liquefaction plant, the plant's working schedule, and the Federal Power Commission's comments are also discussed.

Pt V. In this part storage tanks for inland water transport are dealt with which would have to withstand forces due to pitching, tossing, hogging, and sagging, and of effects in the ullage space of induced wave motions.

Cabot's 1915 barge and the Mississippi barge scheme are discussed, and also manufacture and application of balsa panels for insulation. G. A. C.

ENGINE FUELS

1642. Fuel characteristics and engine design. Fuel supply economics may dictate important changes in time. Anon. *Oil Eng.*, 1957, **24** (284), 442–3.—Very brief article discussing recent papers on fuel supply patterns and multi-fuel engines. C. B.

1643. Fuels and lubricants for tomorrow's cars. C. G. Rosen. *Petrol. Engr*, 1957, **29** (12), C27–30.—The power to vol ratio of automotive engines has increased recently due to an increase in displacement and O.N. Higher C.R. engines utilize gasoline of up to 97 O.N. The application of fuel injection to replace the carburettor will be facilitated by a continuing demand for a higher peak h.p. and by the improvement in performance of modern automatic transmissions. The demand for cheap residual fuels for diesel engines is rising in the U.S.A. Severe lubrication conditions and future automotive engine improvements require the development of suitable lubricants. A. E. R.

1644. Aromatics from petroleum. H. G. McGrath. *Petroleum, Lond.*, 1958, **21** (3), 95–6.—The synthesis of aromatics on a large scale has been a major factor in the increase in octane ratings of motor fuels. Hydroforming and cat reforming are described briefly. The future possibility of synthesizing benzene and toluene from *n*-hexane and *n*-heptane and modifications necessary to produce a sufficiently active cat are discussed. A. E. R.

1645. Volatility of motor fuels. F. Mina. *Riv. Combust.*, 1958, **12** (2), 99–130.—For a long time, O.N. has attracted the attention of engine designers, petroleum technologists, and automobile customers. Gasoline volatility, however, is a fuel property equally related to engine performance on the

road, even if it is not so easily determined as O.N. The paper reviews the volatility factors as R.V.P., ASTM dist, etc., which are considered by many authors in connexion with particular engine and vehicle performance characteristics, *i.e.* easy starting, warming-up, acceleration, and vapour lock. Some lab and road test techniques are examined. After a short survey of the Italian gasoline market situation, a prediction is attempted about the future volatility trends in connexion with the development of processes to comply with the increasing octane demand. (Author's summary.)

1646. Views on multi-fuel engines. One school of thought is not impressed with possibilities. Anon. *Oil Eng.*, 1957, **24** (284), 442.—Brief account of discussions held with members of the oil industry on the necessity for a multi-fuel engine. It is felt that long-term fuel supplies will be adequate, and that there is no necessity to modify diesel engines to burn lighter fuels. The various disadvantages will, it is felt, outweigh the gains derived. C. B.

1647. Microscopy in the examination of diesel fuels. F. G. Rowe and H. F. Nicolaysen. *Petrol. Engr*, 1957, **29** (13), C45–9.—The use of phase and polarized light microscopy in studying diesel fuels is described. Electron micrographs provide a correlation between the age of an oil and the rate of increase in the size and number of coarse particles, and thus indicate the degree of stability. A. E. R.

GAS OIL AND FUEL OIL

1648. Valve control equipment on an oil-firing installation. C. W. Perry. *Fluid Handl.*, 1958, 60–2.—Control system for oil valves, steam valves, dampers, and igniters at an oil-fired power station is described. Valves, etc., are power operated; safeguards against failure of equipment or faulty operating are built in. W. A. M.

LUBRICANTS

1649. Position of the theory of slide bearing lubrication. (In German.) E. Terres and G. Morlock. *Erdöl u. Kohle*, 1957, **10**, 9–14.—Theories, relevant factors, and lubrication conditions—depending on lubricant quantity between the sliding surfaces—are discussed. Oils may be considered equiv in a mechanical sense only if visc, sp. gr., and sp. ht. (all dependent on temp) are identical within the investigation range. Test conditions in the bearing must be identical, *i.e.* bearing play, shaft seating, sliding surface condition must be the same, and consequently the same lubricant film forms at equal load. Lubricity of the oil improves as val of B/vc decreases. Vogelpohl's hydrodynamic theory in no way contradicts that of mol influence. This rests on tests made in a wear-testing machine under quite different conditions—no hydrodynamic lubrication in the sense of the Newtonian equation—as occurs with sliding bearings and with mixed friction. Both theories have some justification. 18 refs. R. T.

1650. Electrical effects accompanying the stick–slip phenomenon of sliding of metals on plastics and lubricated surfaces. G. W. Sohl, J. Gaynor, and S. M. Skinner. *Trans. Amer. Soc. Mech. Engrs*, 1957, **79** (8), 1963–70.—Electrical effects occurring during stick–slip sliding are investigated using a friction machine consisting of a flat rotating metal disk, against which is placed a slider in the form of a sphere, and 4 oscillographs. Simultaneous measurements of electrical transient potential and instantaneous frictional drag or instantaneous load were made. Various combinations of unlubricated metal–metal contact, lubricated metal–metal contact, and metal–plastic contact were investigated. Correlations between time of mechanical stick–slip and electrical transients are obtained. The mechanism of formation of these electrical effects is discussed. 12 refs. C. B.

1651. Predominant peak surface roughness, a criterion for minimum hydrodynamic oil film thickness of short journal bearings. L. F. Kreisle. *Trans. Amer. Soc. Mech. Engrs*, 1957, **79** (6), 1235–41.—The minimum hydrodynamic oil film thickness is defined as the value of minimum oil film thickness at which marginal lubrication begins to be substituted for full hydrodynamic film lubrication. It has the value of the sum of the predominant peak surface roughnesses of the mating journal and bearing surfaces, measured in the circumferential direction, at a point axially centred in the bearing corresponding to the location of minimum oil film thickness. The journals used were solid tool steel 1¼ inch dia, surfaces were ground and ring-lapped. The bearings were bronze with high-speed fine lathe-machined finishes with length to dia ratios between 0·0187 and 0·5020 and with diametral clearance to dia ratios 0·000516 and 0·00157. The running-in of the bearings is described, and an appendix describes the test apparatus and experimental procedure. 9 refs. C. B.

1652. Compatibility of greases. R. Tourret and A. J. S. Baker. *J. Inst. Petrol.*, 1958, **44** (409), 9–13.—Published information suggests that incompatibility of greases can lead to impaired performance in rolling element bearings. Accordingly, the Admiralty Oil Laboratory initiated a programme of tests to investigate this. The ASTM Wheel Bearing Grease Tester and the Shell Microcone Penetration Tester were used in these preliminary experiments. Greases were mixed in different ways, and the method of mixing was found to have an important effect on performance. Consistency measurements were found to have no correlation with incompatibility. Results of leakage and flow in the ASTM test were considered to give a reasonable indication of incompatibility. There was no relation between either unsatisfactory performance of one of the components in the mixture or mixtures of different soap-base greases and incompatibility. 3 refs. C. B.

1653. Some factors affecting piston ring and cylinder wear. Recent Shell Research work on oil engines. Anon. *Oil Eng.*, 1957, **25** (286), 44–5.—An account is given of a systematic investigation into the effects of variables such as oil visc, oil type, engine load and speed, and water temp on piston ring and cyl wear, which was carried out at Thornton Research Centre. Rates of piston ring wear were measured by direct weight-loss, and by radioactive piston ring methods. The effects of fuel and lubricant combinations, and the important role played by additives are discussed. C. B.

1654. The mesomorphic behaviour of the sodium and lithium soaps prepared from oxidized paraffin wax. K.U. Ingold and I. E. Puddington. *J. Inst. Petrol.*, 1958, **44** (410), 41–4.—The oxidn of paraffin wax and the preparation of sodium and lithium soaps from the acids produced is described. The densities of the anhydrous soaps were measured over the temp range 20°–320° C. The apparatus used is described, and results are compared with those of corresponding stearates and of mixtures of sodium soaps. The soaps from the oxidized paraffin wax show a smoother density-temp relationship. The preparation of greases from these soaps is briefly described, and it is suggested that they should exhibit better high temp performance than conventional greases. 34 refs. C. B.

1655. Lubrication of portable air tools. Anon. *Lubrication*, 1958, **13**, 177–84.—Lubrication requirements of typical pneumatic tools are explained with supporting illustrations. Tool design is important. The great diversity of tools and extremes of operating conditions call for the utmost care in choice and application of lubricants, air conditioning, and tool maintenance. R. T.

1656. Cement mill lubrication. Anon. *Lubrication*, 1958, **13**, 185–96. Cement manufacture is described with a flow sheet and illustrations of the heavy and extremely rugged machinery required. Special precautions required to overcome the severe conditions imposed by presence of dust, water, and high temp are described. Choice of correct lubricants for sp machines, which must be of high quality, and lubricant protection against contamination are indicated. Constant research is required into lubrication to meet more stringent requirements in the future. R. T.

BITUMEN, ASPHALT, AND TAR

1657. Investigations on the decomposition and identification of asphaltic petroleum products. (In German.) W. Fuchs and G. Nettesheim. *Erdöl u. Kohle*, 1957, **10**, 15–20.—Investigations are reported on 2 asphaltic residual bitumens of different origin and one blown bitumen, decomp by adsorption chromatography on silica gel into characteristic fractions, which were qualitatively similar in all 3 cases. The important fractions consisted of colourless alkylnaphthenes, aromatics with benzene, naphthalene, phenanthrene and higher nuclei, aromatic ketones, aromatic ketones with O_2- or S-linked bridges. Individual material classes were identified by their u.v. and i.r. spectra and other physical data. The primary bitumens show only very small differences in aromatic and asphalt cont, the blown bitumen shows a very low aromatic portion, and a brittle asphalt portion approx double that of the primary bitumens. Accordingly, the aromatic portion of a bitumen can be considered as raw material for asphaltene formation on blowing. Numerous tabulations and curves are presented. R. T.

1658. Modification of properties of distillation bitumen by admixtures of refined Trinidad. R. Ruck. *Bitumen, Teere, Asphalte, Peche*, 1957, **8** (4), 127–33.—Tests employed in the investigation determine the quality of the properties of Trinidad asphalt as a structural constituent in road construction, by virtue of visc and strength measurements. Results presented in numerous tables and curves show that good improvement can be attained by an addition of 15–20% of refined Trinidad to dist bitumen. R. T.

1659. Investigations on resistance of bituminous sealing materials to lime water. H. Schmitz. *Bitumen, Teere, Asphalte, Peche*, 1957, **8** (3), 82–8.—Bituminous materials—generally considered resistant to alk waters—are attacked in engineering structures by H_2O rendered alk by cement lime. Conclusive evidence is obtained by testing lime water action on conventional tech bitumens used in sealing technique, with parallel tests on H_2O action. At $+30°$ lime water absorption of the material, special pitches excepted, is $=$ or $<$ the water absorption. Pitches absorb less water and lime water than bitumen does. Lime water and H_2O absorption increase with temp, illumination intensity, and decreasing soft. pt. Light effect can be considerable. Soft pitch and special pitch I are sparingly sol in H_2O and lime water. Special pitch II after 221 days at 30° gives solubility 4% in H_2O, 5% in lime water. Soft. pt. and n after 221 days at 30° rose by *ca* 2–9°. Rise of n in lime water action is $>$ in H_2O action, denoting greater embrittlement in lime water. Further comparative results are reported on surface deformation, film permeability, and adhesion of bitumens. The investigations indicate that bituminous materials show good resistance to lime water in comparison with H_2O. 14 refs. R. T.

1660. Binders for coloured coatings and their evaluation. H. Schmidt and W. F. Maass. *Bitumen, Teere, Asphalte, Peche*, 1957, **8** (4), 117.—Sp properties of binders for coloured coatings are discussed. A simple colorimetric method is described, which permits judgment of the relative brightness of binders for coloured coatings. Binders used largely for this purpose—bitumen, bituminous materials, bright binders on the basis of natural and syn resins—are discussed, with reference to their important properties and possible use. R. T.

SPECIAL HYDROCARBON PRODUCTS

1661. Ethylene: technology paints the market picture. J. W. Bradley, R. L. James, and R. F. Messing. *Chem. Engng*, 1958, **65** (2), 88–96.—A survey of 1958 American market statistics for ethylene and ethylene derivatives is made, and the following conclusions are drawn: (1) that consumption has increased 70% in 2 years; (2) that the market is being dictated by progress in research and development; (3) that ethylene is being made increasingly from ethane alone; (4) that economic plant size is increasing, and 200 million lb/p.a. is now the minimum. Ethylene oxide is being increasingly made by the direct oxidn route, and its market is dictated by glycol for antifreeze. Ethanol is the second largest ethylene derivative, but faces increasing competition in markets. Consumption of polyethylene continues to soar, and the new "linear" polymer promises to have a bright future. Styrene accounted for 10–12% of ethylene production, but has dropped sharply in price, though rubber and polystyrene outlets are healthy. Ethylene chloride production for PVC continues to climb. P. J. O.

DERIVED CHEMICAL PRODUCTS

1662. Petrochemicals—1957 and after. H. P. Hodge. *Chem. Age*, 11.1.58, 91–3.—An increase of 32% in output of petroleum chemicals was made possible by an expansion of plant in recent years. A list of major extensions and new plants commissioned in 1957 is given. R. T. T. B.

1663. European petrochemicals. Anon. *Chem. Engng News*, 9.12.57, 84–8.—A survey of petroleum chemical developments in Europe. Shortage of natural gas deposits leads to radical differences in the European and U.S. programmes. R. T. T. B.

1664. Recent developments in petroleum chemicals. P. N. Collinswood, C. F. M. Mackintosh, and H. Steiner. *Petrol. Times*, 14.3.58, **62** (1581), 225; 28.3.58, **62** (1582), 272.—Pt II. Tables show feedstock for the petroleum chemical industry. European synthetic rubber plants, and projects in the U.K., France, W. Germany, Italy, and other European countries are reviewed.

Pt III. Progress is reviewed in petroleum chemical developments in Canada, Japan, and a number of smaller scale units, including Australia, India, and Venezuela. G. A. C.

1665. The chemical constitution of the higher "naphthenic acids." J. Knotnerus. *J. Inst. Petrol.*, 1957, **43** (407), 307–12.—Previously published work on the chemical constitution of naphthenic acids is briefly described, and it is shown that very little investigation has been carried out on the higher mol. wt. acids. The naphthenic acids from a Venezuelan lub oil dist were therefore separated by dist over caustic soda, treatment of the residue with sulphuric acid, and percolation through ammonia. The acids were then esterified with methanol and, after mol dist, reduced to hydrocarbons. These were then investigated by means of elementary u.v. and i.r. analysis, thermal diffusion, and dehydrogenation. It is found that the higher naphthenic acids are in fact carboxylic acids derived from the substituted naphthenes, monoaromatics, diaromatics, and S cpds usually found in lub

oils. Polyaromatics were not found. It is suggested that the term " naphthenic acids " is misleading and should be discarded in favour of petroleum acids. 11 refs. C. B.

1666. Petrochemical problems in Rumania. W. Kisielow. *Nafta (Krakow)*, 1957, **13**, 315–19.—Since Rumanian gas resources reach *ca* ½ billion m³ of 99·5% pure methane and to its production vol of 4000 million m³ in 1955 one must add all refinery gases, it is reasonable to base the country's chemical industry on petroleum hydrocarbons. To this end is directed higher education at the Petroleum Polytechnic in Bucharest under Prof. Raseev, at the C. J. Parhon University under Prof. Nicolescu, and at the Academy of Sciences and Bucharest Polytechnic under Prof. Ninetzescu, who worked out a method for production of low pressure polythene using alkylsodium. In the industry work is directed towards pilot and semi-industrial scale research into the manufacture of detergents, fatty acids, naphthenic acids, and acetylene, and other methods of utilization of methane. Production figures and theoretical advances are listed under the names of the works. The newly created Petrochemical Institute at Ploesti will deal with manufacture of butadiene, treatment of refinery gases, and will have a division concerned with naphthenic acids. There are in existence institutes dealing with utilization of methane at Medias and Copsza Mika, the latter dealing mainly with manufacture of carbon black.

M. S.

COAL, SHALE, AND PEAT

1667. Unit operations reviews. Pyrolysis of coal and shale. C. H. Prien. *Industr. Engng Chem.*, 1957, **49** (9), Pt 2, 1548–52.—Developments in the importance and methods of the pyrolysis of coal and shale in the past year are reviewed. In coal the chief interest has been in low temp carbonization, due mainly to the increasing use of coal for power generation, the fall in coking coal reserves, and the possible utilization of tar as a future source of raw materials. Several new processes are mentioned connected with this method of pyrolysis. Fundamental studies on the mechanism of chemical and physical reactions occurring in the plastic region during carbonization are reported. There has been great development of oil shale resources in the U.S.A., mainly by private industry, stimulated by the Middle East crisis. Research into retorting processes is reported, some of it of Russian origin, and a survey of the economics of the industry and its products is mentioned. 94 refs. D. K. R.

1668. Exploitation of the Athabasca tar sands. T. Gaskell. *Industr. Chem. Mfr*, 1958, **34**, 76–8.—Oil sands of Athabasca, Canada, are *ca* 180 ft thick and cover 8000–30,000 sq. miles. Available oil is between 15,000 and 60,000 million tons, and is mainly asphalt with *ca* 14% gasoline and gas oil and 5% S. By cracking at moderate heat and low pressure, a liq product containing 80% gas oil, 15% gasoline, 5% S is formed, with *ca* 20% wt loss to coke. Oil can be separated from sand by hot (80° C) water washing, or dilution with 15% kerosine and cold (25° C) water washing; latter method may be more promising if processing of the oil is undertaken by refineries built close at hand. Suggested fluidized bed system combines oil separation and cracking simultaneously; sand bed is fluidized by hot gas (85% N_2, 15% light petroleum), oil vapours condensed, and coked sand burned to provide heat for process. Thermal coking process is also proposed which yields up to 41% gasoline and 49% coke. S removal can be accomplished by mild hydrogenation at 1000 p.s.i. and 800° F over a Co molybdenate cat; possible source of H_2 would be CH_4 from expanding Canadian oilfields. Present economics of oil recovery from tar sands is doubtful, but Royalite Co. is building a million tons p.a. plant using cold water centrifugal separation and continuous coking. Transport costs, forming ⅓ total costs, will be reduced as more pipelines are built from Canadian fields, and decision to proceed on larger scale is dictated by economic rather than technical reasons.

A. C.

CORROSION

1669. Embrittlement of 12 per cent chromium steel thermocouple nozzles on a Thermofor catalytic cracking unit reactor. H. H. Bennett. *Corrosion*, 1957, **13** (2), 87–8t.—11–13% Cr steel thermocouple nozzles subjected to temp of 850°–1000° F for *ca* 100,000 hr in a Thermofor cat cracker fractured on removal. Examination showed that near the fracture grain boundaries had widened and the metal was considerably harder (99–103 Rockwell B) than at a cooler location 4 inches away (82–83 Rockwell B), where there was no widening of grain boundaries. This failure is believed to confirm that high Cr steels should be regarded with suspicion after prolonged heating time due to the extended limits of sigma phase formation. F. M. G.

1670. High temperature sulphide corrosion in catalytic reforming of light naphthas. C. Phillips, Jr. *Corrosion*, 1957, **13** (1), 37–42t.—Severe plugging occurred in reactors of cat reformers designed from experience gained in older refinery processes. Tests carried out in the units with shim stock specimens of carbon steel and 2¼ Cr, 12 Cr, and 18 Cr–8 Ni alloy steels showed that the corrosion rate of 18–8 steel was *ca* 1/15 of the high rate shown by the other specimens and that its iron sulphide scale was much more firmly attached. In pilot plant tests, corrosion rates of alloy steels up to 12 Cr were similar to that of carbon steel, except below 0·02 mol % H_2S concn, when they were higher. 18–8 and 25–12 steels were more resistant. Corrosion of all steels began at H_2S concn 0·0075–0·0080 mol %, and it is thought that below this concn the reverse reaction ($FeS + H_2 \rightarrow Fe + H_2S$) is favoured. Aluminized steels in general showed good resistance, but some scale formation observed on the base metal near the uncoated sheared edges which had been attacked may have been due to improper bonding or to damage by cold working. In the case cited, reduction of the S content of the naphtha feed to 40 p.p.m. would reduce the H_2S concn in the total reactor feed to below the corrosive level. F. M. G.

1671. Effect of hot hydrogen sulphide environments on various metals. F. J. Bruns. *Corrosion*, 1957, **13** (1), 27–36t.—Cat reformers and hydrodesulphurizers suffer from the problem of hot H_2S environment. Tests giving close approach to commercial conditions showed that, of the alloys tested, only 18–8 steel was suitable for long service. Lab apparatus and procedure to investigate effect of H_2S concn on corrosion rate is described. Results showed that even with low H_2S concn (0·08 mol %) low Cr steels were not satisfactory and that at least 13% Cr was required if the H_2S concn was not lowered further. Aluminium-coated carbon steels resisted even high H_2S contents. 3 layers of scale were observed and analysed. Materials of construction were chosen with reference to test and literature corrosion rate data. Further testing in units confirmed the suitability of 18–8 and showed that calorizing produced a less hard but more protective Al coating on 4 → 6 Cr–½ Mo steel than hot dipping or hot diffusing. Although

corrosion rates were low in the units, they still suffered from clogging by dislodged sulphide scale. Conversion of reactors from down flow to radial flow, together with desulphurization of feed and recycle gas treatment, practically eliminated operation problems caused by H_2S corrosion. F. M. G.

1672. Analysis of corrosion pitting by extreme-value statistics and its application to oil well tubing caliper surveys. G. G. Eldredge. *Corrosion*, 1957, **13** (1), 51–60t.—The application of extreme-value statistics to estimation of max corrosion pit depth is discussed in detail. Special attention is paid to oil well tubing caliper surveys, and for plotting and studying this data a new method called the Pit Depth Rank Chart has been devised, and its use is explained. The method as applied to one well must be regarded as useful but empirical, and a line of further development of the theory is suggested.

F. M. G.

1673. Casing corrosion in the petroleum industry. J. L. Battle. *Corrosion*, 1957, **13** (2), 132–8t.—Casing failure due to corrosion is rapidly becoming a serious problem in the U.S.A. owing to the age of the majority of wells. The main causes are aggressive fresh water, formation salt water, acidic gases in the vapour zone, and stray currents, while bacterial attack is more significant than was originally thought. Methods of investigation include chemical analysis of produced waters and gases, packer tests to locate depth of failure, caliper surveys, flow line current surveys, and more recent methods, such as casing potential logs and current-potential curves. The most commonly practised preventive measures are the installation of insulating flanges; intermittent oil coverage; use of inhibitors, high alkaline muds, and gel-type materials; cathodic protection; and protective coating or cementing. Repair of failures is effected by setting tubing packers or inside liners; squeezing leak with cement; cutting and pulling corroded section and re-running new section; and " backing off " casing below failure and replacing using modified die nipples.

Conditions, failures, and repair methods in 5 areas where corrosion is high are described and suggestions for prevention of failures are offered. F. M. G.

1674. Testing of coal tar coatings. II. Field exposure in cold climates. W. F. Fair, Jr, C. U. Pittman, and M. G. Sturrock. *Corrosion*, 1957, **13** (3), 191–4t.—A short-term test of 10 different hot applied coal tar coatings is described. 10-ft lengths of 3-inch pipe were buried at depths of 1, 2, 3, 4, and 5 ft in Canada. Each coating was applied similarly to 5 lengths using different coating systems for each 2 ft along the length. One pipe-length coated with each material was buried at each depth. Thermometers were placed inside 2 pipes at each level and the ends were sealed. After a year the pipes were dug up and tested. Despite cold air temp, the recorded temp in the pipes did not fall below +25° F and the coatings showed very few holidays. A complete set of coated pipes was placed for a further year in a large tunnel which gave protection from sun, snow, rain, dirt, etc., but permitted exposure to low temp. At the end of this period it was found that, except in the case of the unplasticized, unwrapped coatings, there were surprisingly few holidays. Minimum temp recorded in the pipes was −8° F. The improvement afforded to unplasticized enamels by glass and felt wrappings is considered significant. It appears that exposure before backfilling is a major factor in low temp exposure damage.

F. M. G.

1675. Suggested coating specifications for hot application of coal tar enamel for marine environments. NACE Technical Unit Cttee T–1M. *Corrosion*, 1957, **13** (3), 209–10t.—Specifications and recommendations on hot applied coal tar enamel coatings have been collected by Task Group T–1M–2. The subjects covered are surface preparation, material and systems, application, and inspection. F. M. G.

1676. Suggested painting specifications for marine environments. NACE Technical Unit Cttee T–1M. *Corrosion*, 1957, **13** (3), 205–8t.—Specifications and recommendations on coating systems for offshore installations have been gathered together by Task Group T–1M–2 on protective barriers. These cover surface preparation, coating materials, application, inspection, and generic types of air drying coatings.

F. M. G.

1677. Corrosion problems and the Shellhaven–Romford pipeline. Anon. *Corrosion Tech.*, 1958, **5**, 78.—The North Thames Gas Board's 24-inch pipeline, 15½ miles long, for conveying oil refinery gas from Shellhaven to Romford is described. Extension to Coryton and Canvey is projected. Steel piping is used to withstand the higher pressures exerted by the possible increased vol of gas carried. The heavy clay soil contains sulphate-reducing bacteria, requiring rigid precautions against corrosion. Treatments described are phosphate application prior to int red-leading, and ext sheathing of filled blown bitumen with interwoven glass. The sheathing terminates 6 inches from each pipe end and firebend. Bare pipe portions are wrapped with Lassovic 10—PVC tape coated with pressure adhesive—protected with roofing felt. CCl_4 and a halogen detector are used for leak testing. A current of 200 mA should give full cathodic protection. Estimated cost of the installation is £500, and running cost for current 24s. p.a.

R. T.

1678. Venezuela's corrosion problem is a special one. C. R. Landers. *Petrol. Engr*, 1957, **29** (12), D28–31.—Venezuela has alternate wet and dry seasons, each lasting 6 months. During the dry season pipeline corrosion practically ceases and may influence the economics of corrosion mitigation. The most widely used mitigation method is line blocking, the placing of concrete supports to separate the pipe from the soil underneath. Cathodic protection is limited by highly resistant soils and little available electric power. Buried lines are generally coated with a standard wrap, but in Lake Maracaibo a boring pest necessitates concrete jackets, aluminium pipe, or deep pipe burial below the mud line. A. E. R.

1679. Application of plastic tape to natural gas pipeline. N. E. Miley. *Corrosion Tech.*, 1958, **5**, 85–6.—Construction of American Louisiana Pipe Line Co.'s 22-inch tie line from Defiance, Ohio, to Bridgman, Michigan, linking up with its affiliate company, Michigan Wisconsin Pipe Line Co., is described. This segment—122 miles long—represents the first large-dia line to be protected with plastic tape. The material used has a total thickness = 0·012 inch—0·008 inch polyethylene film and 0·004 inch adhesive. The thickness is increased on water crossings, swamp crossings, railroad and road crossings. The protective coating over the plastic material consists of an 8-lb, non-perforated, asbestos-saturated felt reinforced with glass fibre. Application is described. Plans are described for testing the durability of the material and the effectiveness of the subsequent cathodic protection provided. A balance of economic factors resulted in an applied cost competitive with conventional processes.

R. T.

1680. Corrosion, cathodic protection, and common sense. B. Husock. *Pipe Line News*, 1958, **30** (1), 49–52.—After a brief description of the various ways of combating corrosion of pipelines, the methods of coatings and cathodic protection are thoroughly discussed. It is pointed out that often more harm is done by applying these protective measures than if no action had been taken at all, due to an incomplete appreciation of the situation being dealt with and the total effect of the measures taken. Many " common sense " techniques are

described, examples being given showing their misuse and their ineffectiveness in certain cases. D. K. R.

1681. Lubricate under corrosive conditions. R. B. Norden. *Chem. Engng*, 1958, **65** (3), 154–6.—The uses of fluorinated oils, greases, and waxes for lubrication under corrosive conditions are listed. They can be used under most conditions, even where silicones are unsuitable, though not with molten sodium, liq fluorine, or liq chlorine trifluoride. Silicone oils have a superior V.I., however. Fluorocarbons are soluble in many hydrocarbons, which are deterrents in a number of applications. They are non-corrosive to metals up to *ca* 350° F, excepting copper, which is discoloured at 120° F; they decompose at 600° F. P. J. O.

ENGINES AND AUTOMOTIVE EQUIPMENT

1682. Preventive maintenance practices for gas engines. Pt 1. H. Ramsey and D. M. Taylor. *Petrol. Engr*, 1957, **29** (13), D34–41.—Major sources of trouble occurring during the running of gas engines for the transmission of gas by pipelines are set out in a classification. A. E. R.

1683. The *William Patterson* in service. Anon. *Oil Eng.*, 1957, **25** (292), 313–16.—An account is given of the *William Patterson*'s first transatlantic voyage since 6 orthodox GS.34 1250-g.h.p. gasifiers mounted side-by-side in a row feeding 2 3000-s.h.p. Alsthom expansion turbines were fitted. Detailed descriptions of the machinery are given. Esso 3600-sec Redwood I Bunker C oil was used as fuel, diesel fuel being used for starting and manœuvring. Shell free piston engine oil was used as cyl lubricant. The article is well illustrated, and typical performance curve diagrams of the GS.34 gasifiers are given. C. B.

SAFETY PRECAUTIONS

1684. Toxicity of plastics. Anon. *Packaging*, March 1958, **40** (338), 46.—This is a review of the British Plastics Federation report providing a standard for the determination of the plastic hazard. Principles of assessment of the toxic hazard, unit of toxicity, toxicity quotient, and a table of toxicity are discussed. G. A. C.

ECONOMICS AND MARKETING

1685. Remember all three in cost analyses. F. C. Jelen. *Chem. Engng*, 1958, **65** (2), 123–8.—Following from previous articles, the joint effect of rate of return on capital, company income taxes, and inflation on costing of plant is considered. The basis used is capitalized cost, *i.e.* the first cost plus the present value of an indefinite number of renewals, to get equations expressing the effect of these 3 factors on costs. P. J. O.

1686. Fuel—price and cost at average U.S. refinery. W. L. Nelson. *Oil Gas J.*, 17.3.58, **56** (11), 190.—Tables show price indices and prices of refinery fuels and approx fuel costs in average U.S. refineries. G. A. C.

1687. Liquid fuels in European and Polish economy. C. Kaczmarski. *Nafta (Krakow)*, 1957, **13**, 319–23, 341–2.—The author reviews figures of oil and coal production between 1937 and 1956. Whilst the former has risen from 251 to 839 million tons, the latter rose much less spectacularly. W. Europe's consumption is below the world average, but the rate of expansion is greater. Figures for each nation are given with comments. For the future the prospects are that in 1960 W. Europe's refining capacity will reach 160 million tons p.a. The cal. val. of gas to be produced in 1960 will reach the equivalent of 14 million tons of coal. By 1960 the U.S.S.R. and Rumania are planning to produce, respectively, 135 and 10–12 million tons of oil. Russian figures for 1950–60 are as follows: 1950, production, refining capacity, and cracking capacity were, respectively, 37·9, 36·3, and 13·5 million tons, in 1955, 70·8, 65·0, and 32·9, and plans for 1960 envisage 135·0, 110·0, and 58·0 million tons p.a. M. S.

MISCELLANEOUS

1688. Resourcefulness—our industry's greatest resource. C. J. Hedlund. *Proc. nat. Gas Ass. Amer.*, *36th ann. Conv.*, 1957, 64–7.—The geographical pattern of world oil consumption is shifting constantly, and international developments, *e.g.* the Suez Canal incident, often result in sharp changes in the supply patterns. The world's growing needs for oil in future years call for great flexibility to deal with these problems. Worldwide petroleum demand—growing by 8% p.a.—has more than doubled in the past 10 years. The U.S.A.—in terms of vol—represented in 1956 over ½ world consumption (57%). In Europe demand has doubled every 5 years, due to the post-war reconstruction boom, and the apparent inability of indigenous coal to supply its share of energy needs. Oil is left to fill the energy gap. In the last decade, oil demand in areas other than the U.S.A. and Europe has grown by *ca* 10% p.a. This vast area, including Asia, Africa, Canada, and Latin America, offers the greatest potential for expansion. Rising demand for oil places great responsibility upon the world's oil industry. This responsibility for supply calls for max efforts to cover rising demands and, at the same time, to preserve supply flexibility and competitive vigour. A detailed picture is presented of the complete revamping of the world's oil flow to meet Europe's vital needs for petroleum during the recent crisis. The U.S.A. must face up to the problem of oversupply. In order to have supply flexibility, capacity must be carried to supply more than customers want

to consume. Spare capacity must be handled wisely, and preparation must be made to meet the challenge of new energy sources. R. T.

1689. Oil and education. Lord Godber. *J. Inst. Petrol.*, 1958, **44** (409), 1–7.—After a brief review of the career of John Cadman, after whom this 5th Memorial Lecture is named, Lord Godber considers the effect of the rapid technological advances, to which the oil industry has contributed a large part, on the general development of various nations. He stresses that education must be broad, to produce the right man for the right job, and to create in all people the understanding that will enable the right man to do the right job most effectively. The awards made by the oil industry to fulfil specific educational needs in various countries are described. Finally, the shifting emphasis from employee training to a general interest in education, with its wider beneficial results, is discussed. C. B.

1690. Techniques of presentation in education and training. A. I. S. Debenham. *J. Inst. Petrol.*, 1957, **43** (401), 142–7.—The techniques of group instruction and discussion leading, and role of training aids are discussed. 5 pages of discussion. C. B.

1691. Survey of new refinery construction. Anon. *Oil Gas J.*, 24.3.58, **56** (14), 200.—Survey shows little increase in crude running capacities, but rather in processing design to increase product quality. G. A. C.

1692. Survey of refineries in United States. Anon. *Oil Gas J.*, 24.3.58, **56** (12), 159.—Location and capacities, as of 1 Jan. 1958, for refineries in the U.S.A. are listed. Operating capacities were increased to more than 9,700,000 b.s.d. G. A. C.

1693. Netherlands: oil entrepôt. Anon. *Petrol. Press Serv.*, 1958, **25**, 95–7.—Execution of large current projects for expanding the oil port and refining capacity at Rotterdam, and for a crude oil pipeline from there to the Ruhr, will enhance the significance of oil in the economy of the Netherlands. The check to the sharp economic expansion of recent years and other restricting factors are reflected in the slower expansion in demand for petroleum products last year. At only slightly <5 million tons, it rose by 200,000 tons or 4·6%, compared with an overall increase in 1955 and 1956 $\sim$23%. Inland consumption has doubled since 1951, and a doubling of present consumption is foreseen within 10 years. The Suez crisis and the mild, wet summer accounted for fluctuations in sp fuels. The most significant rises have been in black oils, which now account for 70% of total inland consumption, and are expected to increase. Ocean bunkering is assuming increasing significance, and the demand for diesel oil bunkers for canal and river craft in and beyond the Netherlands increases continuously. Deliveries this year are expected to be $>2\frac{1}{2}$ million tons. When the new refinery projects are completed the Netherlands refinery capacity will reach *ca* 21 million tons p.a., compared with 14 million tons at present. At BPM's Pernis refinery, facilities exist for petroleum chemical production, to which synthetic general purpose rubber will be added. An important development last year was the big jump in local crude output to 1·5 million tons. There is a small but useful production of natural gas. R. T.

1694. The role of Canadian banks in the oil and gas industry. A. D. Insley. *Canad. Min. metall. Bull.*, 1958, **51** (550), 108–10.—Canadian banking policy—with rigid curtailment of sp loans—is explained, to clarify its bearing on the relationship developed between the oil industry and the banks. At the time of the Leduc discovery banks were not permitted to take mortgage security of any kind when granting a loan. The complicated procedure for obtaining a loan was changed at the decennial revision of the Bank Act in 1954. Under Section 82 of the Act a bank can now obtain a charge on the oil and gas in the ground and on the well equipment. Examples of assistance given to oil companies are quoted. Production loans are granted for further development where 2 or more successful wells have been drilled, and the bank receives assurance—supported by experts—that estimated recoverable oil reserves for the producing wells, and the average net monthly revenue accruing to the company, will protect required loans adequately, and provide a satisfactory repayment programme. Assurance is required that no prior claims on production proceeds exist and an adequate market for the oil is available. Figures given illustrate a sp case. Workovers require a separate loan. The Petroleum and Natural Gas Conservation Board—among its activities for conservation control of oil and gas resources—prevents discrimination against any producer. An oil-refining company may borrow against its inventory of crude oil and refined products. R. T.

1695. Hydrocarbon Research Group Report 1954–56. Anon. *J. Inst. Petrol.*, 1957, **43** (408), 323–4.—Brief account of the activities of the Hydrocarbon Chemistry Panel, the Spectroscopic Panel, and the Mass Spectrometry Panel, describing research work sponsored, and meetings held and planned for the future. C. B.

1696. Gas industry confident: spending $2 billion a year on new facilities. R. W. Otto. *Pipe Line News*, 1958, **30** (1), 20–2.—Details of the advances made by the gas utility and pipeline industry during 1957 are given, and confidence for the future is shown by a development plan costing $8·7 billion to be spread over the next 4 years. During 1957 a swing from manufactured and mixed gas to natural gas occurred. Various relevant statistics are given under the following headings: customers increase in 1957; sales and revenues; natural gas reserves; underground storage and pipelines; gas appliances and equipment; promotion, advertising, and research. D. K. R.

1697. Technical use of tall oil. (In German.) Anon. *Bitumen, Teere, Asphalte, Peche*, 1957, **8** (4), 142–4.—A compilation of 212 references to tall oil, its processing, and applications. R. T.

BOOK REVIEWS

Proceedings of the Second International Congress of Surface Activity. London: Butterworths Scientific Publications, 1957. £16.

It is nearly 250 years since Francis Hawksbee gave the first correct account of capillary action in tubes, and a tremendous wealth of knowledge on surface activity has accumulated in the meantime. The present extent of the forefront of the field can be judged on the number and diversity of papers contained in the four volumes of these proceedings, which together embrace 197 papers in the 1842 pages of text.

The term " surface activity " is popularly understood to mean the influence of substances on liquid/gas or liquid/liquid interfaces. In the present context, however, a much wider interpretation is used, including also solid/liquid, solid/gas, electrical, and biological phenomena. Whilst most of the papers relate to physical effects, a few deal with chemisorption.

Surface activity is not only a vital concern of the petroleum chemical and detergent industries, but also occupies a large and expanding place in the petroleum industry. For example, the refiner is concerned with mass transfer in two-phase systems (washing, solvent extraction, etc.), as well as with emulsification, foaming, and evaporation losses, each of which is the subject of several papers in these proceedings. No less important is the increasing use in these days of surface-active additives to improve the detergent, anti-corrosion, anti-icing, and other properties of final products. Production of crude oil, too, is dependent on interfacial effects within the pores of the rocks, whilst the properties of clays in suspension all too often present headaches to the mud chemist. At least one paper (in Vol. 4) is relevant to this last problem.

Vol. 1. *Gas/Liquid and Liquid/Liquid Interface* (56 papers). Pp. ix + 521. 90*s*.

The opening papers deal with insoluble films and are concerned largely with the structures and properties of monolayers deposited at liquid/gas or liquid/liquid interfaces. These studies are likely to be of interest to those concerned with fundamental aspects of lubrication and of detergency. Ries and Kimball show a beautiful series of electron micrographs of monolayers of *n*-hexatriacontanoic acid and have been able to study at high resolution the mechanism of monolayer collapse. The resolution is much better than 1 monolayer thickness (50 A). A paper from the Kodak Research Laboratories describes "A direct reading electrically operated balance for static and dynamic surface tension measurement." The repeatability using the apparatus described appears to be 1·5 dynes/cm, which is comparable with the published precision of method IP 90/55T; however, it is claimed that a tenfold improvement can be obtained by using larger plates.

A further section deals with the stability of foams, and all five papers are of fundamental interest. They are followed by three papers on the retardation of evaporation from water surfaces (reservoirs) by the deposition of films at the air/water interface. Evaporation is a subject of considerable concern to the oil industry, which might well consider the admittedly more difficult application of similar techniques to hydrocarbons.

Refinery treatments, such as solvent extraction, water washing, etc., depend on absorption at liquid/liquid interfaces, and fundamental aspects are dealt with in three papers in this volume. Using a drop weight method, Cambridge workers have measured absorption in times as small as 0·1 second. Another paper deals with the stability of aqueous droplets resting on an oil/water interface.

Questions on the production, coagulation, and properties of oil/water emulsions are also dealt with, and in the reviewer's eyes this is one of the most interesting parts of Vol. 1. Davies and Haydon consider the Bancroft rule and the hydrophilic/lipophilic balance classification for emulsion type and proceed to develop their own kinetic theory, which will no doubt interest those concerned with the practical consequences of the type of emulsion formed in a process.

Linton and Sutherland describe experiments on the circulation of liquid in a drop which is moving in another liquid in which it is immiscible. Drops with low initial interfacial tension circulate readily, and much higher rates of extraction of solute are obtained than with drops having high initial interfacial tension. Blokker describes the effect of surface-active agents on mass transfer across liquid/liquid interfaces and concludes that any decrease in rate of transfer is due to the secondary effect of turbulence at the interface rather than to the resistance of the surface film itself.

Vol. 2. *Solid/Gas Interface* (36 papers). Pp. viii + 348. 75*s*.

The first two-thirds of the book concerns physical adsorption of gases on solids. It is refreshing to find papers describing applications of some relatively new techniques in this field, such as infra-red and magnetic resonance studies of physically adsorbed layers. A short and very readable account of surface energies of solids is presented by Brunauer and is well worth reading by those interested, but not well versed, in the subject. De Boer gives a useful review of recent work at Delft University on "the origin and structure of the pore systems of activated aluminas."

The last part of the book is concerned with chemisorption. Schwab gives an introduction to the subject, and the 12 papers include contributions from the Shell Development Company on "Oxygen adsorption and exchange on silver catalysts" and from the Houdry Process Corporation on "Heats of adsorption of water on dehydrated oxides" (alumina, magnesia, thoria, silica).

Vol. 3. *Electrical Phenomena. Solid/Liquid Interface* (66 papers). Pp. x + 621. 100*s*.

The first 15 papers are concerned with electrical phenomena, and one or two of the papers may be relevant to fundamental studies in the fields of corrosion and of anti-static additives. Otherwise it is difficult to see any direct bearing of the papers on the petroleum industry.

The remainder of the book contains papers on several topics which are highly relevant to the industry, particularly in the field of lubrication research. Bikerman opens with a provocative paper on solid surfaces in which he discusses such phenomena as the effect of surface roughness on wetting. Several papers deal with spreading and wetting in such systems as aqueous solutions on paraffin wax and pure hydrocarbons on chromium and chrome steel.

The relationship between adhesion and friction is discussed by two of our leading authorities, Bowden and Tabor, but none of the remaining five papers on adhesion deal with metal surfaces.

Two papers from Russia and one each from Britain, the U.S.A., and Italy comprise the section on lubrication. Derjaguin and Karassev have studied the viscosities of various liquids as a function of distance from the solid wall. They conclude that for non-polar liquids the viscosity is strictly constant right up to the wall, whereas with some polar materials sharp changes occur near the wall. I-Ming Feng demonstrates that dissolved gases, such as oxygen in a boundary lubricant, can greatly affect the wear rate. Nasini *et al* discuss the protective and lubricating properties of various cutting emulsions. Deacon and Tabor have studied the lubrication–temperature characteristic of perfluorodecanoic acid, a close relative of PTFE, which is well known to have an extremely low coefficient of friction. Finally, Rehbinder and Lichtman discuss the "Effect of surface-active media on strains and rupture in solids."

Well removed from the field of lubrication is a paper by Mondria on a novel process for dewaxing oil using surface-active agents and utilizing the phenomenon of wetting reversal. The process is claimed with reservations to have proved successful in laboratory and pilot plant tests and to be more economic and/or efficient than conventional processes. Kipling presents a lot of data on the effect of the solid surface on selective adsorption from binary mixtures of benzene, *cyclo*hexane, alcohols, methyl acetate, ethylene dichloride, etc.

Vol. 4. *Solid/Liquid Interface. Cell/Water Interface* (39 papers). Pp. viii + 352. 75*s*.

The greater part of this volume is concerned with such matters as the washing of textiles, suspensions, agglomerates,

etc. A novel particle sizing method, applicable in the range 25–2 μ or less, is described. It depends on sedimentation potentials and can be applied only when the liquid phase is ionic. The advantage of the method is that no prior knowledge about the system (*e.g.* density, viscosity) is required. A further paper discusses the use of tannin extracts to influence the physical properties of clay suspensions in drilling muds.

The last section of the book is entirely biological.

The four volumes are well printed, and each contains a classified list of titles, together with authors, for the papers within its covers. The volumes would make an attractive and useful addition to the shelves of any petroleum library.

R. W. C.

Gas Turbine Materials. G. Lucas and J. F. Pollock. London: Temple Press, 1957. Pp. xi + 163. 25*s*.

The authors, in the preface, state that the objective of their book is a survey of the subject. This survey is designed to fill the gap between text-books on metallurgy and those on gas turbines. They have therefore chosen a very difficult task and have nearly, but not quite, managed to master the problem of choosing the important and essential information from both specialized subjects. It is a difficult matter to decide what the reader of a book of this nature requires in the way of background information, and this is where the authors are sometimes inconsistent. The general design of the book is good, but there are occasions when too much detail is given. There are, on the other hand, occasions when insufficient information is given, especially when technical terms are used which, while quite acceptable to one reader, would be unfamiliar to another. In view of the book's stated objective, this is a fault which may annoy. The layout of the book might be improved by a style of writing which would require less effort on the part of the reader. In the main, however, the language is simple.

The range of contents is rather ambitious. The book contains only 163 pages, but in this space it endeavours to survey the thermodynamic principles of gas turbines; the properties and use of metals, ranging from light aluminium alloys to cobalt base alloys of the heat-resisting type; and also surveys gas turbine fuels. The result of this is that, inevitably, some aspects of the survey receive undue attention and the reader requires to be careful as to the importance of some of the subjects discussed.

The book is not well balanced, possibly because the authors have tried to present too much. The first 26 pages, for instance, give a very readable and useful historical survey on heat-resisting alloys. This seems excessive with regard to the present-day importance of the information. Nevertheless, the book is enjoyable to read and will provide a handy reference for anyone interested in this subject.

R. G.

Big Oilman from Arabia. Michael Sheldon Cheney. London: Heinemann, 1958. Pp. 320. 21*s*.

Mr Cheney's fascinating book can be described very shortly by the word " delightful."

Starting with an American contractor in 1948, Mr Cheney saw developments in the Arabian American Oil Company from the constructor's angle, living rough and hard for a year in Dhahran and in the Tapline camps. Following a year's break, he returned to Saudi Arabia in 1950 as an employee of the oil company and for the next six years occupied a number of very interesting positions in the administrative set-up of Aramco. He was thus in a position to see many facets of the operations before the 50/50 deal that set the Middle East oil concessions pattern, as well as the after-effects on the company. Moreover, as his work necessitated visits to numerous officials and townships, he was able to assess the impact of the new deal on the people of Saudi Arabia.

Mr Cheney has obviously kept an open mind on all he has seen—unlike many working in a relatively closed community whose horizons are bound by the office door, the house compound, and the club. He has not been afraid to point out in his book the faults of his company, nor has he spared the ruling family or government officials of Saudi Arabia, where the worst of the feudal past is trying to stem evolution with a heavy club. The aspirations of the Arabs have been recorded, as well as the problems of an administrative machine in an oil company endeavouring to translate archaic ideas into modern practice in an atmosphere of suspicion. And from the parochial Mr Cheney turns in his book to the international and sets down the problems of the world politicians in dealing with Buraimi disputes, the Suez crisis, and Arab nationalism.

This is by no means a text-book. Descriptions are written in vivid English, and the turn of phrase makes delightful reading, while the absence of American jargon and slang will commend itself to the reader in Britain. To those who have worked in the Middle East the book will bring back memories of Arab acquaintances, if not by name at least by inference, for most will recognize, in Abu Tofik and others, similar types. To such as have not had the fortune to see transition in action the book will be illuminating. To all it will be something they must try to finish before putting the volume down.

D. A. C.

Petroleum Refinery Engineering. Fourth Edn. W. L. Nelson. New York: McGraw-Hill Book Co. Inc., 1958. Pp xi + 960. £5 15*s*. 6*d*.

This book is familiar to all who are engaged in petroleum technology, and comparison with the third edition, which appeared in 1949, shows it to have been largely re-written and increased by over 100 pages of text. The chapter headings are unchanged, which is an advantage for those familiar with previous editions, new information being added within the previous plan. There is no doubt that this edition of " Nelson " will continue the reputation that the work has enjoyed for many years.

There have been two major developments in petroleum refining since the third edition was written. The first is catalytic reforming, particularly over platinum catalysts, and the second is sulphur removal by selective catalytic hydrogenation. The present edition of the book must have been written during the boom in catalytic reforming, the striking advantages of catalytic reforming being such that refiners in a competitive market are virtually compelled to install equipment for it; yet the whole subject is given only 6 pages compared with 50 for catalytic cracking. The reviewer feels that the special engineering and technological interest of these plants is not well described; the implications of a strongly endothermic reaction using a very expensive and delicate catalyst, often without periodic regeneration, which leads to the use of reactors of special construction, the economics of conditioning the recycle gas by drying and removal of acid gases, the implications of using alloy steels for almost the entire process part of a large unit, and finally the reason for the plants, and their special advantages, are given scanty attention. Information on catalytic hydrogenation for removal of sulphur is also poor; the catalyst for the Shell Hydrodesulphurization process is cobalt–molybdena on alumina, not tungsten–nickel sulphide, and the footnote reference should read 1953 not 1955. Perhaps the author is waiting until these later developments can be described as history before granting them a place of honour.

The present work has a useful appendix of properties of

about 160 crude oils, mostly those of the New World, but with a representative selection from the Middle East fields and those of the Far East, arranged in order of API gravity. The chapters on processing, distillation, solvent treatment, heat transfer and furnaces, and on catalytic cracking continue to be the best that the petroleum engineer can find in a single volume handbook and in bringing these up to date the author has performed a service to the petroleum refining industry.

Literature references are given to include 1956 and are adequate for an understanding of the text. The book continues to be produced to a high and pleasing standard, and is well indexed for authors and subjects. Where the third edition was good the fourth is better. D. P. P.

Wear. Amsterdam: Elsevier Publishing Co. Bi-monthly, £5 7*s*. 6*d*. per annual volume.

The first four issues of this technical bi-monthly devoted to consideration of the fundamentals of friction, lubrication, wear, and their control in industry display a wide scope and international character. For example, nine authors from four different countries contribute papers to the first issue, which is dated August 1957. Their subjects are friction and wear of synthetic fibres, the theory of hydrodynamic lubrication, wear of rubber-covered steel stirrers, and roller-bearing failure.

The language used for most of the papers is English, but all the summaries are also given in a second language, which is usually German. The papers which are written in German or French have English summaries. Both typography and the reproduction of the illustrations deserve praise. The photographs are very clear, and the printing of the mathematical formulæ sets a high standard of legibility.

Papers are drawn not only from Europe. The four issues also contain articles from Australia and the U.S.A. Of special interest is an account which considers the mechanism of boundary lubrication and the properties of the lubricating film prepared by a member of the Soviet Academy of Science with assistance from three members of the Institute of Physical Chemistry in Moscow.

Each issue also contains biographical notes on the contributors, abstracts of current scientific and technical literature, bibliographies, and a calendar of forthcoming events.

Analysis. A series of papers reprinted from *Research*. Vol. 9, 1956. London: Butterworths Scientific Publications, 1957. Pp. 69. 8*s*. 6*d*. (postage 7*d*.).

This volume brings together in convenient form nine articles on the general subject of analysis which appeared in *Research* during 1956. In the opening article E. W. S. Press discusses the range of analytical methods available and the difficulty of selecting the appropriate one. The remaining eight articles discuss respectively: gravimetric, volumetric, and absorptiometric methods; standards, separation, and sampling; infra-red spectroscopy; polarography and electrical methods; radiochemical methods; potential new methods; the mass spectrometer; and emission spectroscopy.

The volume will be a useful adjunct for the analytical chemist and a valuable reference work to developments in analytical tools.

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P

OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

1698. East Texas basin offers new type fields. J. A. Kornfeld. *World Oil*, 1958, **146** (1), 104.—Recent significant finds in the E. Texas basin have stimulated exploration in the area. These are listed and the geology of the basin, which is one of the richest in N. America, is outlined. 3 main objectives are sought in current exploration: the flanks of interior salt domes, deep formations in fault zones, and shallow formations along the S. rim of the basin. The Jurassic, Cretaceous, and Eocene have been found productive in recent interior salt dome flank discoveries and also in fault segments of the Mexia and Talco fault systems. Development of interior salt domes has been revived following 2 Woodbine sand finds at Hainseville and Bethel in Wood and Anderson Counties.

At Boggy Creek shallow Eocene–Wilcox has been found productive, giving a new objective for the S. rim of the basin. In the up-dip Mesozoic belt, Jurassic gas-condensate development is important, and there is similiar development in the New Hope field, Franklin County, in the down-dip Mesozoic belt.

A contour map shows the structure of the pre-Cotton Valley Jurassic in the E. Texas basin. C. A. F.

1699. Operators in Anadarko hit nearly one out of two. W. E. Swearingen and A. C. Hayden. *Oil Gas J.*, 21.4.58, **56** (16), 230–3.—Success ratio of wildcats drilled in the N. Anadarko basin in 1958 was 48%. Stratigraphic traps are common, *e.g.* at the change of facies from sandstones to limestones at the edge of the basin, in which every geological formation is represented. Subsurface geology determined from existing wells is the best method of exploration, and success ratio should increase as control improves. Principal reservoir rock is the Pennsylvanian Morrow sandstone, which produces gas, condensate, or oil. There are 8 other productive horizons in the Pennsylvanian and one each in the Mississippian and Ordovician. J. C. M. T.

1700. How to make profit below 15,000 ft. H. J. Reedy. *Oil Gas J.*, 14.4.58, **56** (15), 166–71.—The deep retrograde condensate reservoir of the Carter–Knox field, S. Oklahoma, was discovered in 1956. 4 completed wells have calculated open-flow potentials ranging from 10,000 to 32,000 M.c.f/day of wet gas. Development wells to the third Bromide averaged 15,950 ft deep, and cost average of $959,627 each. The second and third Bromide sands, the basal McLish sand, and the basal Oil Creek sand have all been proved productive, and there are indications of gas also in the Sycamore, Hunton, and Viola limestones. Structure of these pre-Pennsylvanian beds appears to be an unfaulted, asymmetric anticline, but the overlying lower Pennsylvanian is intricately overthrust. Permian surface beds are near-horizontal with some normal faulting. J. C. M. T.

1701. Mesaverde hit fires Powder River search. J. C. McCaslin. *Oil Gas J.*, 14.4.58, **56** (15), 176–7.—The Powder River basin of Wyoming is one of the largest in N. America, with prolific fields around the folded and faulted edges. Production has now been established nearer the centre of the basin at Dead Horse Creek, discovered in June 1957, where there are now 27 wells producing from the Cretaceous Parkman–Mesaverde zone. 5 miles NW., Davis Oil Co. 1 Federal has tested 20 brl/hr at 6680–6701 ft from the same zone. J. C. M. T.

1702. Williston may rival W. Texas. N. S. Morrisey. *Oil Gas J.*, 24.3.58, **56** (12), 253–9.—Until recently the main pay zone in the Williston basin was the Mississippian Madison limestone, but recent deep tests have indicated pay zones in the Devonian, Silurian, and Ordovician, while Cretaceous and Jurassic formations are also productive. Many Cretaceous surface anticlines continue downward into the older formations, contrary to earlier ideas, and may reflect basement uplift or faulting. Unlike most Rocky Mountain basins, the Williston basin produces chiefly from carbonate rocks. J. C. M. T.

1703. Discovery challenge of the Rockies. A. I. Levorsen. *World Oil*, 1958, **146** (1), 99.—Although many fields have been found in the Rocky Mountain area, oil possibilities are greater than ever, and until the drilling density in the area is very much higher it is not possible to estimate the undiscovered reserve. It is emphasized that the decrease in the drilling of closed anticlines does not mean that fewer fields will be found, for many other types of trap can exist, and future exploration will be concerned mainly with searching for stratigraphic traps of various kinds. Some of these traps can be associated with anticlines, and several different hypothetical combination traps of this kind are briefly described, with diagrams. Many possibilities exist for combination traps related to domes; they may be near the top of the fold or well down the plunge, and it is claimed that many wells must be drilled before all the domes in the area have been completely tested. Many wedge-outs exist in the Rocky Mountain area, and these range in extent from local to regional in development. Many thousands more wells must be drilled to the basement before even an approx estimate of the ultimate reserves can be made. A diagram shows the common ways in which formations can wedge-out. C. A. F.

1704. More oil around Spindletop. N. Williams. *Oil Gas J.*, 7.4.58, **56** (14), 106–7.—16 discoveries have been made within a radius of 30 miles of the 1901 Spindletop gusher within the past year. Some of these are in the original shallow sand and cap rock sector, others farther afield are in the Marginulina, Frio, Hackberry, and Nodosaria sands at 7500–11,000 ft. 8 are classed as new field discoveries. Chief of these is Port Acres, *ca* 8 miles SE. of Spindletop. J. C. M. T.

1705. Alberta's pre-Cretaceous oil and Cretaceous gas. J. R. Pow. *Oil Gas J.*, 28.4.58, **56** (17), 151–3.—*Ca* 27% of the recoverable oil reserves and 41% of the disposable gas reserves of Alberta have been discovered within conglomerate and sandstone reservoirs of the Cretaceous. The remaining reserves have been found mainly in the limestone and dolomite reservoirs of the Mississippian and Devonian. Maps showing the distribution of oil and gas fields producing from different formations are provided. J. C. M. T.

1706. Sedimentology of the Betsiboka estuary (Madagascar). L. R. Lafond. *Rev. Inst. franç. Pétrole*, 1957, **12** (4), 425–31.—The Betsiboka drains a large area in N. Madagascar, and passes through areas which can supply it abundantly with sands and other materials. At all seasons it has a considerable load of solids. This load can vary rapidly, and can attain 2·3 g/litre. Its flow varies widely. In the region of Ambato Boeni and beyond the low plain receives considerable thicknesses of clay each year. Extensive deposition is taking place in the estuary; there are beach sands, fluviatile sands, and estuarine muds and muddy sands. Size distribution curves are simple for the beach sands outside the Bay of Bombetoka, but more complex for the deposits of Majunga. Some deposits are a mixture of traction material and flocculated suspended matter.

It is estimated that the river transports 300×10^6 tonnes/year. Because of silting, the future of the port of Majunga is uncertain. G. D. H.

1707. Japan steps up hunt. Anon. *Oil Gas J.*, 28.4.58, **56** (17), 76.—In a 2-year old programme of intensive domestic exploration, Japan has so far made 3 new-field discoveries and found a new producing horizon in its biggest field at Yabase. New areas are at Tamugiyama in Niigata prefecture, Barato, near Sapporo, the capital of Hokkaido Island, and Fukura in Yamagata prefecture. Seismic work has been done off the W. coast, and offshore drilling there is planned. Current production is 6000 b.d. from all fields. J. C. M. T.

1708. Foraminifera and ostracods from the Oxfordian of Villers-sur-Mer (Calvados). J. J. Bizon. *Rev. Inst. franç. Pétrole*, 1958, **13** (1), 3–35.—An extensive series of samples from the cliffs of Oxfordian beds at Villers-sur-Mer have been studied, and 39 foraminifera and 21 ostracod species are described. The former belong to the *Lituolidæ*, *Textularidæ*, *Verneuilinidæ*, *Miliolidæ*, *Ophthalmiidæ*, *Lagenidæ*, *Polymorphinidæ*, and *Rotaliidæ*, while the latter belong to the *Polycopidæ*, *Cytherellidæ*, *Bairiidæ*, and *Cytheridæ*. A chart shows the occurrence and frequency of the various species. The Quenstedticeras marine zone had 32 species of foraminifera and 9 species of ostracods, with *Lagenidæ* dominant. The Cardicceras cordatum zone had 26 foraminifera and 6 ostracod species, a number being new forms (*Espostomina* sp. 1, *E. mosquensis*, *Cytherella*). The Argovian was characterized by *Vaginulina pasquetæ*, n.sp., *Lenticulina polonica*, var. 1, and *Neobulimina varsoviensis*. The Rauracian showed only 14 species, but was well marked by *Macrodentina*. sp., and M. cf. *punctata*.

Some of the forms may be of stratigraphic importance in the Anglo-Parisian Basin and in NW. Germany. G. D. H.

1709. Fault block distribution of North West German space. (In German.) G. Brinckmeier. *Erdöl u Kohle*, 1957, **10**, 133–41.—Information obtained by geophysical investigations and drilling has provided detailed stratigraphic, lithological data on the most dominant structures, the flanks of fault blocks, and sedimentary basins. The whole region—presented as specific mutually-related fault blocks—is characterized by salt plugs the formation of which is discussed. A relation exists between ht of salt rise and depth of adjacent Tertiary–Cretaceous synclines. Discovery of anticlines disclosed oil accumulations. Under marine transgression, dome-like undulations, generally complicated by foldings, overthrusts, and faulting, occur. All oilfields in NW. Germany produce currently from Jurassic or Cretaceous, oil having originated probably in deep sedimentation synclines. Facies maps and 9 refs. R. T.

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

1710. Dip migration improves depth calculations. W. B. Robinson. *World Oil*, 1958, **146** (2), 45.—For the accurate prediction of depths to reflecting horizons in seismic work it is necessary to apply dip migration principles, and methods of calc are outlined. If the profile is not migrated it will generally show highs which are too wide and lows which are too narrow. Drafting and graphical techniques for correction are described. C. A. F.

1711. Aerial photograph surveying in the Yemen. (In German.) A. Wolfes. *Erdöl u. Kohle*, 1957, **10**, 65–7.—This illustrated article describes the procedure for obtaining topographical maps of the Yemen terrain to a scale of 1 : 25,000. A series of motion pictures is taken in relation to a frame of visible traverse points the map position of which is determined terrestrially. The modern broad-angle objective " Aviogon " permits photographing from 4600 m height to a scale of 1 : 40,000, taking 50 km² on one exposure. Topographic maps to all scales—of great val to the geologist—are produced by stereoscopic measurement of the pictures in precision mapping instruments. Where this does not suffice, further magnification to the scale of 1 : 5000 is employed. Advantages over the classical terrestrial procedure are discussed. R. T.

DRILLING

1712. Engineering planning and supervision of directional drilling operations. J. E. Edison. *J. Petrol. Tech.*, 1957, **9** (11), 16–19.—Controlled directional drilling is necessary: (1) to correct the natural course of a well, and (2) when the location renders a vertical hole impossible or impracticable. The former group includes correcting drift, side-tracking fishes, deflection from the non-productive to the productive side of a fault. In each of these cases the problem of deviation arises after the well has started. The second group is one in which directional drilling is planned before the well is started, and the first step is to decide whether this method is the cheapest and most satisfactory solution of the problem. In relief wells there is no choice. Costs as well as risks must be considered.

A competent and experienced directional control specialist is an important asset. A rig which can make hole as fast as possible is necessary to reduce risks due to long exposure of open hole. The circulation system is of paramount importance; it should give at least 2 ft/sec. The commonest trouble is stuck drill pipe or casing. The rotational torque needed is high because of the position of the drill pipe, and a minimum of 400 h.p. delivered has been suggested for peak loads. Above-average crews and supervision help, and the indicated target dia should be as large as possible, thereby speeding operations and calling for fewer whipstocks. It is wise to start deviation as soon as possible, and a build-up of $2\frac{1}{2}°$/100 ft to the max angle required is good practice. A bit one size larger than for vertical holes makes the running of casing easier. Oil emulsion mud offers advantages.

For a series of directional holes going to nearly 8000 ft, and with *ca* 4000 ft drift, costs per ft of hole were *ca* 15% higher than for vertical holes. 45% of rig time was on rotating, 20% making trips, and 9% surveying. G. D. H.

1713. Volume requirements for air or gas drilling. R. R. Angel. *J. Petrol. Tech.*, 1957, **9** (12), AIMME Tech. Paper No. 4679, 325–30.—Air or gas drilling has given penetration rates as high as 90 ft/hr in shales. Circulation rate is important, and in quarries velocities of 3000 ft/min have given best results.

The cuttings vary in size, and the distribution changes with level due to grinding by the drill string and turbulent flow. Slip tends to increase down-hole pressure and reduce annular velocity.

The circulation rate needed to give annular velocities equivalent in lifting power to a given velocity of standard density air is given by:

$$\frac{6{\cdot}615\ (T_s + Gh)\ Q^2}{(D_h^2 - D_p^2)^2 V_s^2} = \sqrt{[P_s^2 + b\ T_{av}^2]\ e^{2ah/T_{av}} - bT_{av}^2}$$

where

$$a = \frac{SQ + 28{\cdot}8\ KD_h^2}{53{\cdot}3Q} \text{ and } b = \frac{1{\cdot}625 \times 10^{-6}\ Q^2}{(D_h - D_p)^{1{\cdot}333}\ (D_h^2 - D_p^2)^2}.$$

D_h = hole dia, ft; D_p = outside pipe dia, ft; S = specific gravity of gas relative to air; T_s = absolute surface temp in annulus; G = annular temp gradient, ° F/ft; h = depth considered; Q = circulation rate, s.c.f/day; V_s = velocity of standard air, ft/min; P_s = abs pressure in annulus at surface, lb/ft²; T_{av} = average abs temp of flow stream; K = drilling rate, ft/hr. This relationship indicates that other standard equations which ignore the solids in transit may underestimate vol requirements by as much as 50%.

Since particle sizes and shapes cannot be predicted, it is recommended that a standard air velocity of 3000 ft/min should be used as a basis for calculation. The relationship has to be solved by trial and error, a tedious process. However, Datatron solutions have been calculated for certain conditions, thought to represent average field conditions. An approximate solution is given which is satisfactory except for small holes and high drilling rates; it can be used with reasonable accuracy down to 10,000 ft.

Examples of the approximate solution are given.

G. D. H.

1714. Safety, profit, and drilling. D. L. Morgan. *World Oil*, 1958, **146** (2), 56.—Requirements designed to reduce hazards in drilling are listed and briefly discussed, results from comprehensive safety studies having shown that safety in drilling operations is related to higher profits. Safety requirements are listed under the following headings: (1) requirements for a good safety programme on a drilling rig; (2) specific items needed in a big safety programme; (3) specific items that constitute unsafe conditions and working practices; and (4) special safety devices. It is emphasized that the concept of safety in the drilling industry differs from that in general industry, and there is a general assumption that accidents are to be expected in drilling operations. There is therefore a need for safety programmes which can help to make drilling as safe as possible. C. A. F.

1715. Development and field testing of a core barrel for recovering unconsolidated oil sands. A. B. Hildebrandt, H. C. Bridwell, and J. M. Kellner. *J. Petrol. Tech.*, Jan. 1958, **10** (1), 51–3.—Surveys and preliminary tests indicated that the core must be held together as cut, not damaged by fluid circulation, continuously supported, and packaged to survive the trip out of the well, yet able to be removed from the barrel without disturbance. A rubber sleeve core barrel meets the basic needs. This sleeve has longitudinal fabric cords to prevent lengthwise stretching; it is forced over the core by the advance of a stationary barrel. The drill stem does not advance in the coring operation.

Shallow tests were first made and then deep tests which brought to light problems of sanding of various parts, and the need for changes in bit head design. These changes gave 95% recovery from 6 cores cut at 3200 ft. A 10-ft barrel was then made, and this on test had 89% recovery from an unconsolidated oil sand–shale series. A bit is desirable which will penetrate hard or gummy beds mixed with soft sands. Work is in progress on the use of diamond bits.

It may be possible to recover broken formations which tend to bridge in conventional barrels. G. D. H.

1716. What it takes to plan a super-deep well. R. W. Holman. *Petrol. Engr*, 1958, **30** (3), B31–40.—The planning of a deep well, projected to reach a record depth of 24,000 ft and designed to drill to 25,000 ft, is described. Already the largest single cement job has been performed, using the longest string of 13⅜-inch casing in a 17½-inch hole. At great depths friction losses will be reduced by the use of a combination string of drill tubing, so that surface pressures will not exceed the capacity of the mud pumps. A. E. R.

1717. Could we drill a 50,000-ft hole? P. Weaver *et al.* *Petrol. Engr*, 1958, **30** (3), B44–50.—Problems of drilling a 50,000-ft oil well are discussed, neglecting economic considerations. Probable temp range encountered will be 450°–700° F, and equipment will have to be modified to meet the high pressure and temp requirements. With development of suitable rig equipment and bits, and the solution of other difficulties, the feat is considered possible. A. E. R.

1718. Birth and worldwide development of electrical logging. R. Seydoux. *Bull. Ass. franç. Tech. Pétrole*, Jan. 1958, 5–15.—Conrad Schlumberger began work on electrical prospecting in 1912, and in 1919 his brother Marcel joined him. In 1923 the first commercial surveys took place, and in 1926 the Société de Prospection Electrique was formed. In 1920 they had the idea of making measurements in boreholes to check the results of surface electrical surveys. In Sept. 1927 the first well survey was made in Diffenbach 2905 at Pechelbronn. Resistivity measurements were made point by point on a potentiometer, and they were lengthy. The curves showed now well-known features, and a few weeks later the first correlations between 2 wells were made.

In 1928 Royal Dutch Shell was approached about applying electric logging, and contracts were made for work in Venezuela and the Dutch E. Indies. The first survey was made in California in 1929, but in mid-1930 the first American venture was ended.

S.P. logging was added to the resistivity log to give additional information. 1931 saw the technique introduced to Russia, and in 1932 work began again in America. At the end of 1938 60 sets of equipment were in use in the U.S.A., 19 in S. and Central America, 12 in Europe, 35 in Asia, and 5 in Africa.

Conrad Schlumberger died in 1936.

During 1957 700 sets of equipment were in use making 150,000 surveys/year. 1000 carefully chosen engineers are at work, 650 being in the U.S.A. Of the 360 outside the U.S.A. more than ½ are French; however, of the last 100 recruited only 27 are French, a proportion less than the figure aimed at.

G. D. H.

1719. Plastic patch seals casing leaks. Anon. *Petrol. Engr*, 1958, **30** (3), B52.—Holes in drill casing are being repaired successfully by the application of a thermal setting plastic with an inexpensive inflatable mandrel. Little reduction in the effective i.d. of the casing is caused, thus presenting no obstruction to equipment. Pressure tests showed that holes were effectively sealed up to ¼-inch dia at external pressures of 8000 p.s.i. A. E. R.

1720. The effects of weight and speed on penetration. A. Lubinski. *World Oil*, 1958, **146** (1), 120.—The study of weight/speed penetration in drilling is complicated by the rapidly changing nature of the drilling characteristics of formations from bed to bed. A method is therefore proposed which permits the determination of an entire rate *v.* weight curve over a very short interval, usually a few inches. It consists of recording, or reading and plotting, weight *v.* time during drilling-off periods. An example is given, and it is shown that the number of experiments could be much smaller than with the current technique, with consequent savings in time and costs. Diagrams illustrate the method. C. A. F.

1721. Cost-bearer calculation in rotary drilling operation. (In German.) C. E. Böttcher. *Erdöl u. Kohle*, 1957, **10**, 67–73, 147–51.—Pt 1. Performance, survey, and operation account sheets. Drilling costs encompass not only the costs immediately connected with drilling, but all costs connected with preparation, execution, and supervision of a well; also all calc costs of aux operations, vehicle parks, workshops, and apportioning of the works' general costs. Analysis of the costs is discussed and presented as a tabulation of the cost calculation of wells as cost bearers, performance of drilling installation supervision, and operational calculation sheets. Pt 2. Cost-bearer calculation. A special cost-bearer sheet is necessary for each well, since one borehole cannot be compared with another of different depth. The cost-bearer calculation is divided into 2 sections: cost-bearer total review, and distribution of working phases. Details are discussed, and a cost-bearer sheet and a summary of instructions for cost distribution to the work phases are presented in tables. 9 refs. R. T.

1722. Most hole for your money. J. W. Speer. *Oil Gas J.*, 31.3.58, **56** (13), 90–6; 7.4.58, **56** (14), 148–56.—Pt 1. Empirical relationships are developed to show the influence on penetration rate of weight on bit, rotary speed, and hydraulic h.p. Penetration rate varies approx proportionally with weight on bit for materials usually penetrated, provided there is sufficient fluid circulation to ensure clean bottom conditions. Bit wear, however, also increases, so that for each formation an optimum bit weight exists. A tentative curve for determining this optimum weight is provided, requiring the prior measurement of the penetration rate index of the formation. Similarly, rate of penetration and bit wear increase with rate of rotation, and a curve relating optimum rate of rotation to bit weight is developed.

Pt 2. There is a critical hydraulic h.p. for each value of weight on the bit for a given formation, above which no increase of penetration rate occurs, and below which bottom hole cleaning is inadequate. This optimum h.p. increases with bit weight. For a given pump hydraulic h.p. there is an optimum division between circulating rate and nozzle velocity; although variable, 50–70% of the pump hydraulic h.p. at the bit is satisfactory. Jet bits usually give better results than conventional bits.

Determining optimum drilling conditions for a given rig involves several weight *v.* penetration tests on major formations encountered. This data, plus that given in the charts provided, enables the operator to select the best combination of rotary speed and bit weight to suit the available equipment, or alternatively, to determine changes in equipment which would improve performance. J. C. M. T.

1723. Power rig has steam-drive feel. E. McGhee. *Oil Gas J.*, 24.3.58, **56** (12), 208–10.—Smooth load take-up and stalling without damage at a predetermined torque are advantages claimed for a new type of hydraulic coupling incorporated in the rotary table and aux drawworks. The coupling is mounted in parallel with the master clutch. When the master clutch is disengaged, the amount of torque transmitted is closely controllable by altering the quantity of oil in the coupling. The adjustment is made by a pneumatic control from a lever on the driller's console. J. C. M. T.

1724. Power swivel attractive. Anon. *Oil Gas J.*, 14.4.58, **56** (15), 64–5.—Rotating the drill-pipe by means of a power swivel, instead of with the rotary table, has several advantages. It is possible to drill down 90-ft stands, thus saving connexion time. Drill string can be effectively rotated while lifting, making for easier recovery of stuck pipe. Better core recovery is claimed, as there is no need to lift the core bit from the bottom, as when adding singles in normal coring operations. The device described uses hydraulic power, can develop 14,000 lb ft of torque, and rotate at 140 rev/min. J. C. M. T.

1725. New ways to evaluate formations. H. M. Johnson. *Oil Gas J.*, 14.4.58, **56** (15), 105–11.—The effects of commonly-used mud types, additives, and contaminants on the evaluation of formation properties and contents are reviewed, mainly from the point of view of the interpretation of electric logs. J. C. M. T.

1726. New concept for workovers. Anon. *Oil Gas J.*, 28.4.58, **56** (17), 80–4.—The use of small dia tubing run inside the production tubing for working over wells is described, and is claimed to afford major economies over conventional methods. The method may be used for sand removal, set-cement removal, squeeze cementing, displacement plug cementing, and acidizing. The lower zone of dual completions can be worked over without affecting the upper zone. It is necessary that the well be completed with open-ended production tubing bottomed above all completion intervals. High-pressure triplex pumps are necessary for washing and cementing owing to the high friction losses in the small dia tubing used. The method has been extensively tested by Gulf in the Louisiana Delta area. J. C. M. T.

1727. Rotary coring from small boats. R. A. Mills. *World Oil*, 1958, **146** (2), 51.—Hydraulic rotary equipment mounted on boats has been used to drill shallow core holes in the Gulf of Mexico. Details of the equipment and method of drilling are given, with diagrams and photographs. The drill is carried on the stern of the boat, at least 30 ft of deck space being required. The basic equipment consists of hydraulic drawworks and swivel, an aluminium A-frame, drill pipe, drill collar, slip joint, core barrel, and the drilling platform. A 30-h.p. air-cooled petrol engine drives the drawworks with hydraulic pump motors which can deliver pressures up to 2000 p.s.i.

Wire line is used to eliminate round trips and to prevent caving by unconsolidated sediments, wave motion being compensated for by a slip joint inserted in the drill string and by an arrangement which separates the swivel from the oscillating boat during the coring. The boats used are from 75 to 100 ft in length, and the drills can recover cores from depths down to 100 ft below the sea floor. The boats should be anchored into the wind and current to reduce boat roll; 4 100-lb anchors set equidistant from the boat at right angles to one another have proved satisfactory. C. A. F.

1728. Let's re-examine casing design considerations. R. J. Stomp. *World Oil*, 1958, **146** (2), 60.—Basic factors in the design of well casing are briefly discussed, only collapse, tension, and burst being considered. For simplicity, discussion of important variables, such as clearances, landing procedure, and wear caused by drilling, is omitted. C. A. F.

1729. Special additives cut cement costs. E. W. Porter. *World Oil*, 1958, **146** (2), 63.—Problems of the control of cement density, retardation, and water loss have been studied in order to provide more efficient cement jobs and to reduce costs. Field tests have been carried out, and 3 additives have been developed: (1) a diatomaceous earth, which reduces the density of slurries; (2) a cellulose derivative, which controls water loss and thickening time of slurries; (3) a special form of sodium silicate, which can accelerate slurries when retardation is unnecessary. With the additives slurries can have densities as low as 10·5 lb/gal and water loss down to 5 ml/30 minutes. Details of slurries and test results are given, with diagrams of temp curves used to compare results. The importance of selecting a particular blend of cement for each well or field is emphasized. 4 refs. C. A. F.

1730. What's ahead in high strength tubular goods. A. B. Wilder. *Petrol. Engr*, 1958, **30** (2), B95–100.—The development of higher strength seamless piping for drill tubing and casing is described. A new type of thread and improved production methods have increased the pipe yield strength up to 135,000 p.s.i. A. E. R.

1731. A high-speed low-torque drilling device. G. E. Cannon *Petrol. Engr*, 1958, **30** (3), B82–90.—The development of a high-speed drill driven by a turbine for drilling hard formations with a low bit weight, suitable for use in directional drilling, is described. In drilling, a cutting wheel rotates about its horizontal axis while the entire tool is rotated about the axis of the pipe by the drilling tube. After overcoming mechanical difficulties, tests showed that the drilling rate obtained with the device was normally less than that obtained with a conventional rotary drill. However, development is under way. A. E. R.

1732. "Extreme pressure" lubricated mud. Anon. *Petrol. Engr*, 1958, **30** (3), B160.—A drilling mud additive that

lubricates drill bit bearings and the hole, even under the high-pressure conditions of a deep hole, is described. Tests showed that bit wear was reduced 2 to 5 times, and the drill pipe rotating torque decreased to $\frac{1}{3}$–$\frac{1}{5}$ of that with conventional muds. Reduction of friction reduces wear on drill pipe and rig, and enables the easier recovery of lost tools and pipe. A. E. R.

1733. Laminar flow of drilling mud due to axial pressure gradient and external torque. R. P. Paslay and A. Slibar. *J. Petrol. Tech.*, 1957, **9** (11), AIMME Tech. Paper No. 4651, 310–17.—An approx solution has been obtained for the laminar flow of drilling mud in the annulus when the velocity gradients due to axial flow are large compared with those due to rotation of the drill pipe, using 3-dimensional stress-deformation rate equations for a Bingham plastic. The core thickness decreases due to the external torque for a given value of axial pressure gradient. The influence of an external torque on the vol rate of flow for a given axial pressure gradient decreases as a percentage as the axial pressure gradient increases. The core velocity at a given pressure gradient is increased by the application of a small torque. G. D. H.

1734. High mud pressure increases penetration. R. A. Watson and R. S. Sullins. *World Oil*, 1958, **146** (1), 113.—By using increased pump hydraulic h.p. substantial increases in penetration rates have been made in S. Louisiana. H.p. has been increased from 500 to over 1500 in 12¼-inch and 8⅝-inch wells where formations are mainly soft and can be drilled rapidly. It was found that increases in hydraulic h.p. increased penetration rate both with weighted and with normal weight muds. Drill pipe dia should not be less than 5 inches. Theoretical considerations of the problem are discussed, together with details of field experience, and it is shown that there is reasonable agreement between the theoretical data and field experience. Further improvements in the pump and other surface equipment will be required before the h.p. can be efficiently increased further to 2000 hydraulic h.p., as a surface pressure of 5000 p.s.i. must be held. Improved methods of chip generation are also needed if optimum results of the increased h.p. are to be obtained, and increases in pump h.p. will be of little value if adequate bit weights are not maintained. Diagrams show the effect of bit weight and hydraulic h.p. on drilling rate for some S. Louisiana fields. C. A. F.

1735. Chart to determine pump output, annular velocity, tank volume, and mud gradient. L. M. Crane and A. C. Perricore. *Oil Gas J.*, 14.4.58, **56** (15), 112–13.—A nomogram is presented which enables mutual relationships of the parameters mentioned in the title to be investigated without calculation, starting from known dimensions, such as hole dia and drill-pipe size, pump liner size and stroke, and linear tank measurements. J. C. M. T.

1736. Bentone slurry completion fluid. J. C. Broom. *Oil Gas J.*, 14.4.58, **56** (15), 116.—Bentone slurry consists of a bentonite–organic complex mixed with diesel oil to form a gel, with barite added for weight. Provided it is not contaminated with water, Bentone slurry of 10·1–18·1 lb/gal is stable regardless of time and temp, and can therefore be used as a casing-tubing annulus completion fluid. If used only in the lower portion of the annulus below a water-base fluid, an oil buffer must be used between them, otherwise the tubing is likely to stick near the interface. J. C. M. T.

1737. How to control slurry density. J. P Moran and D. G. Hartweg. *Oil Gas J.*, 28.4.58, **56** (17), 88–90.—A new densitometer measures the density of slurry being pumped to a well by determining the absorption by the slurry of energy from a radioactive source. Density is recorded directly on a chart within the range 8–18 lb/gal with an accuracy of 0·1 lb/gal, giving a continuous record of density throughout the cementing job. J. C. M. T.

1738. Economic and technical problems of drilling muds of C.R.E.P.S. A. Thomas and R. Dupont. *Bull. Ass. franç. Tech. Pétrole*, Jan. 1958, 61–74.—Because of the remoteness of the Saharan operations transport costs are high, and hence the effective cost difference between France and the Sahara may change markedly, and expensive low bulk materials may begin to be attractive. Thus C.M.C. is preferred to fucus in the Sahara; the reverse is true in France. As a result, Saharan operations have used bentonitic, C.M.C., and starch muds, the first to start the wells, the second to *ca* 1500 m, and the third generally at greater depths. Some of the waters used are quite saline, and treatment with Na_2CO_3 to prevent flocculation of bentonite by Ca has been necessary. Early muds at Edjeleh had filtrate of 8 cc, visc 40 sec, density 1·15, resistivity 2·5 ohms m²/m at 20° C. Oil having been found, efforts were made to improve the muds to avoid water-block and to ease log interpretation. Filtrate of *ca* 5 cc and resistivity *ca* 0·5 ohm m²/m were needed. These were obtained using bentonite, quebracho, starch, C.M.C., and salt in appropriate amounts, and log interpretation was improved.

Cores were studied by thermal methods to identify the nature of the clays present. At Edjeleh and Tiguentourine they were identified as kaolinite in the Lower Visean and Tournaisian. The amount was 10–25%. A series of synthetic muds was made to test for water-block effects depending on interfacial forces, and some of these included some crude and Hyflo. The effect of their filtrates on the passage of crude through core plugs was examined. A crude bentonite–C.M.C.–starch–soda–salt–Cassel earth mud with 1% Hyflo seemed best.

Tables summarize the properties of the muds studied. G. D. H.

1739. Drilling progress meterage and production of the German petroleum recovery industry in 1956. (In German.) H. Pfefferkorn. *Erdöl u. Kohle*, 1957, **10**, 216–18.—With 165 rotary outfits and 105 lighter outfits, firms engaged in recovery and location of oil in the Federal Republic produced a total drilling meterage of 707,948 m in 1956. Tabulations present a detailed analysis of drilling operations—26,000 m meterage < in 1955—for 1956. R. T.

1740. Geological results of petroleum wildcat drilling activity in 1956 in West Germany. (In German.) E. Malzahn. *Erdöl u. Kohle*, 1957, **10**, 201–16.—A review of the extensive oil and gas discoveries in W. Germany in 1956. Discoveries were 11 new oil deposits (1 in E. Holstein, 3 in the region between Elbe and Weser, 4 between Weser and Ems, 3 in the Upper Rhine Valley), and 6 new gas deposits (1 in Emsland, 4 in the Upper Rhine Valley, and 1 in the Alpine Foreland). Discussion of each region in detail is supported by petroleum geological maps, and tabulations showing structures and formations of oil and gas regions, and oil and gas deposits according to stratigraphic arrangement. R. T.

PRODUCTION

1741. Progress in well-completion methods. Pt 3. Increasing permeability of formations about producing wells. L. C. Uren. *World Petrol.*, 1957, **28** (12), 106.—Well-completion techniques in many cases now involve increasing the natural permeability around the well bore by artificial methods. These are reviewed and comprise: (1) acid treatment of carbonate reservoir rocks to enlarge drainage channels; (2) fracturing by explosives or hydraulic pressure to form fractures in the reservoir rock; and (3) the injection of chemical reagents into the pores of the rock in order to increase its relative permeability to oil.

In choosing the appropriate method of well-completion, consideration must be given to the character of the reservoir rock, the nature of the fluids it contains, and the natural expulsive forces which exist. Thorough logging, sampling, and testing of the pays is therefore required. 47 refs. C. A. F.

1742. Effect of fluid pressure decline on volumetric changes of porous rocks. J. Geertsma. *J. Petrol. Tech.*, 1957, **9** (12), AIMME Tech. Paper No. 4678, 331–40.—In porous media there is rock matrix compressibility, bulk compressibility, and pore compressibility; there are pore stress variation and bulk stress variation, the former being hydrostatic, whereas the latter may be directional. In consolidated sandstones it seems that the deformations are usually purely elastic; shales, however, are visco-elastic.

For an isotropic porous medium it appears that 3 elastic constants and 3 viscous constants are required to describe pore and rock bulk compressibilities if porosity is introduced explicitly. Purely elastic deformation can be described by 3 deformation constants, and deformation of purely viscous porous material by 3 constants. In each case 2 constants refer to rock bulk and one to rock matrix material. Thus no direct measurement of fluid displaced from the pores is needed.

For a sandstone bulk shear modulus, bulk and rock compressibilities are needed. It seems that for isotropic oil sands the pore compressibility present may be *ca* ½ that measured in the lab under uniform and constant boundary conditions.

Apparatus for measuring the required parameters for obtaining compressibility data is described. G. D. H.

1743. Sampling procedures for oil reservoir fluids. F. O. Reudelhuber. *J. Petrol. Tech.*, 1957, **9** (12), 15–18.—Fluid samples should be obtained as early as possible in the producing life of a field. Whether surface or subsurface samples are taken, the draw-down can cause the fluids collected to differ from the virgin reservoir fluid. For a saturated reservoir, and before permeability to gas develops, the fluids entering the borehole will be saturated at the bottom-hole pressure, which will differ from the reservoir pressure. Well conditioning for sampling therefore requires reduction of flow rates for 24–72 hr, and then closing in for 24–72 hr, which forces gas in the sand near the well into solution. This may yield a subsurface sample approaching that for the true saturation pressure. Correction may be made by adding gas to give the correct saturation pressure, provided that the gas is of the right composition; alternatively, the sample may be analysed and the data extrapolated to the appropriate pressure.

Surface samples in the early phase of production will give a solution gas/oil ratio less than the initial value; the reverse will be true later. The latter error would be more easily detectable if the reservoir pressure is known. The surface samples for the later dates will have gas different from that liberated in the reservoir.

Undersaturated reservoirs present fewer sampling problems, provided that the bottom-hole pressure is above the saturation pressure. Conditioning procedure should be of the same type as for saturated reservoirs, the reduced rate being maintained until the produced fluid is sufficient to have absorbed any accumulated gas.

Conditioning is the same for pumping as for flowing wells, but for pumpers the well should be shut in and the pump removed. Then one or 2 tubing vol of fluid should be slowly swabbed followed by closing in overnight with removal by slow swabbing of *ca* 20% of the standing fluid. This should give satisfactory subsurface samples. Surface samples present many problems, especially if gas is produced from both casing and separator.

A static pressure traverse should be made to show that water is not standing at the base of the well. Then 2 subsurface samples are collected at the correct depth and opening pressure, and the saturation pressure measured immediately on recovery. Transfer to suitable containers is then made above the saturation pressure. G. D. H.

1744. Method for predicting the back-pressure behaviour of low-permeability natural gas wells. M. R. Tek, M. L. Grove, and F. H. Poettman. *J. Petrol. Tech.*, 1957, **9** (11), AIMME Tech. Paper 4665, 302–9.—Experimental determination of the stabilized back-pressure curve requires at least 3 flow tests, each starting with nearly static pressure distributions and each of proper duration to ensure stabilization. The stabilization time becomes large when the permeability is small; hence tests are wasteful of gas and time-consuming. Based on relationships derived by Houpeurt, working methods have been proposed. The relationship between gas producing rate and the overall pressure drop between the reservoir boundary and the well bore is:

$$Q = \frac{2{\cdot}49}{G}\,(4{\cdot}659)^{n} v \left(\frac{\pi kh}{\mu}\,\frac{b}{\log_e \frac{R}{r_w}}\right)^{n} (P_s^2 - P_f^2)^n.$$

G is gas gravity; R drainage radius; v is a function of the range of production rates and the slope of the back-pressure curve, n; $b = \frac{29G}{ZR'T'_f}$, Z being the gas compressibility factor under bottom-hole flowing pressure and temp. All the quantities before the term $(P_s^2 - P_f^2)^n$ represent the performance coeff; $\frac{\pi kh}{\mu}$ is the "test-index." Relationships are given for the drainage radius, R, and the effective well-bore radius, r_w.

Field tests were carried out to check the theories advanced for obtaining the performance coeff. Draw-down and build-up tests were employed. The latter afforded data on effective permeabilities, static reservoir pressure, effective well-bore, and drainage radii. Analysis of data from 15 wells permitted comparison of measured values of the performance coeff with predicted values. Statistical examination revealed a bias of 7·14% and a standard deviation of 11·6%.

Summaries of the results and an example of the calculations are given. G. D. H.

1745. An investigation of the role of capillary forces in laboratory water floods. F. M. Perkins. *J. Petrol. Tech.*, 1957, **9** (11), 49–51.—Capillary forces are involved in water-drive and exert a controlling influence on the microscopic fluid distribution, thereby affecting the saturation or microscopic flow behaviour. The pressure differentials under flow across a few pores are usually several orders of magnitude less than the capillary pressure difference. In water flood, large differences in saturation at the flood front cause large capillary pressure gradients. The tendency of water to advance ahead of the flood front leads to a diffuse displacement front, and at low rates such a front may extend over the entire length of a lab column. A boundary effect leads to a relatively high water saturation near the outflow face.

A 12-inch, 1¼-inch dia sand column in a lucite tube had 19 potential electrodes and 2 current electrodes along the axis. After creating an oil mass with interstitial water N/10 NaCl was used to give displacement at 1·4 ft/day. In a repeat 36 ft/day was used.

Water saturation profiles were measured via the resistivity between pairs of electrodes. At the low rate water reached the outflow end at 0·41 pore vol of oil recovery, but water was not produced until water injection was 0·6 pore vol and the oil saturation at the outlet end was about the residual saturation. Oil production was almost complete after 2 pore vol of water injection. At the high rate water reached the outflow and at 0·6 pore vol oil recovery; the front was less diffuse than at the low rate, and the boundary effect was less.

31 floods were made on columns 9·8, 13·8, and 39·4 inches

long. Plots of oil saturation at water breakthrough and of residual oil were made against the product of column length and injection rate. The residual oil saturation was constant whatever the value of the product, but the oil saturation decreased as the product increased to a minimum above a certain value of the product; the variations at low values indicate the increased importance of capillary pressure effects. The residual oil is determined by capillary forces and is not rate-sensitive. G. D. H.

1746. Special applications of drill stem test pressure data. J. P. Dolan, C. A. Einarsen, and G. A. Hill. *J. Petrol. Tech.*, 1957, **9** (11), AIMME Tech. Paper No. 4667, 318–24.—Improved pressure recorders now in use in drill stem testing can read to within 1% at pressures over 1000 p.s.i.g.

Pressure build-up curves may be analysed via the relationship,

$$P_o - P_w = 162{\cdot}6\,\frac{q\mu}{kh}\log\frac{(t_o+\theta)}{\theta}$$

where P_o is the pressure at an infinite boundary, t_o the total flowing time, and θ the shut-in time. The assumptions and boundary conditions inherent in this are more nearly realized in a drill stem test than in conventional flow and build-up tests.

Detailed pressure and time readings can be obtained from the records by optical projection on to graph paper. Mud pressure can be compared with mud weight as a check on the recorder. Experience of plotting D.S.T. charts on semi-logarithmic paper shows that straight lines are usually obtained when kh/μ is greater than 10 mD-ft/cP; below this value the plots are usually curved, and this also arises with non-radial flow. One of the main causes of non-usable D.S.T. pressure charts is insufficient shut-in time relative to the flowing time and the kh of the formation. The lower kh, the greater the time needed.

Using the average producing rate the effective permeability is given by $\frac{kh}{\mu} = 162{\cdot}6\,\frac{q_a}{\Delta P}$ when the flowing curve is approximately straight. In addition, the D.S.T. data can also give the productivity index, and the damage ratio (approximately $0{\cdot}183\,\frac{P_s - P_f}{\Delta P}$, where ΔP is the pressure difference over one logarithmic cycle), as well as affording information on nearby barriers. G. D. H.

1747. Whole-core analysis methods and interpretation of data from carbonate reservoirs. R. S. Bynum and E. H. Koepf. *J. Petrol. Tech.*, 1957, **9** (11), 11–15.—For cores with erratic porosity development there may be fractures or vugs comparable in size with conventional test plugs. Hence there will be advantages in using much larger samples. Cores should be cut as quickly as possible with a good drilling fluid, rapidly pulled, extracted, examined, and properly preserved for lab tests. In cutting, the core suffers flushing to the irreducible minimum oil saturation on many occasions. In pulling, gas evolved from the residual oil expels oil and water until only gas flows. The core should be wiped, not washed, then frozen or put in plastic bags to prevent fluid loss. Examination is made for fractures, vugs, and changes in lithology. Photographs may be taken, and a γ-ray log made to link with the well radioactivity log. Lengths of 12–20 inches are selected for measurements.

Fluid extraction may be by modified Dean–Stark procedure, vacuum retorting, or pressure injection of solvent saturated with CO_2. The Dean–Stark method may take several weeks. Vacuum retorting takes several hours. Liq saturation or Boyle's law methods are used to get porosities. Permeability is measured in 2 directions at right-angles parallel to the bedding, and also perpendicular to the bedding.

The fluid saturation data are for flushed or partly flushed rock. Several examples of whole-core analyses of limestones are discussed. Any gypsum in the rock will lose water on heating (90° F upwards). This increases pore space, and appears as apparently water-saturated pore space.

The cores can indicate the type of fluid that will be produced, and afford preliminary data on reserves and recoveries. G. D. H.

1748. Selective plugging of input wells. H. G. Botset and P. F. Fulton. *World Oil*, 1958, **146** (1), 152.—Selective plugging of water input wells in the Bradford field, Pennsylvania, has been very successful and over $3 million have been saved in water costs. The purpose of the plugging is to reduce produced water/oil ratios, so that substantial benefits result. The mechanical techniques are briefly summarized, and 3 ways of measuring the effect of the plugging agent on the injection well are described. The first involves measuring the pressure fall-off curve for the well, the second the measurement of the localized injectivity index, and the third involves measuring the skin effect at the well. The first is sensitive to the selectivity of the plugging, whereas the last 2 only indicate that there has been plugging. The usual plugging agent is an aq suspension of resin of particle size less than 1 micron.

The treatment has been carried out on several leases since 1946, and accurate records have been kept of well performance. The results from 3 properties are outlined, with diagrams showing production histories. During the 9-year period, until the end of 1955, it is estimated that over 248,467,000 brl water were saved. C. A. F.

1749. A diffusion model to explain mixing of flowing miscible fluids in porous media. J. S. Aronofsky and J. P. Heller. *J. Petrol. Tech.*, 1957, **9** (12), AIMME Tech. Paper No. 4668, 345–9.—Fluid mixing during flow through a porous medium has been analysed in terms of the diffusion equation with a mass transfer term when there is no density or visc contrast, and the fluids are incompressible. No detailed assumptions are made about the mechanism of displacement. The fluids are completely miscible. The equations have been applied to published data, and satisfactory agreement was obtained on the selection of the effective diffusion constant. Support was found for von Rosenberg's conclusion that the length of front is proportional to the square root of the distance travelled. On the other hand, it appears that the peak height in a slug displacement cannot be represented over any extended region by so simple a relationship as that proposed by Koch and Slobod. G. D. H.

1750. Improved blotter model for analogue studies. C. A. Fothergill. *J. Petrol. Tech.*, 1957, **9** (12), 55–6.—The model uses a thin plastic sheet held on a wooden base by adhesive tape. The input wells are brass drawing pins with heads beneath the sheet, and connected to the negative current terminal. Blotting paper saturated with 0·2N – K_2SO_4 soln with phenolphthalein indicator is pressed over the pin points to give the model, while the anode consists of soln-saturated blotting paper cut to a point and suspended by a crocodile clip connected to the positive terminal. The point just touches the horizontal field sheet.

With the anode 4 cm from the wells 135 V d.c. gave a coloured front which completed its advance in *ca* 10 minutes.

Various well patterns can be simply represented by these means. G. D. H.

1751. Compressibility of undersaturated hydrocarbon reservoir fluids. A. S. Trube. *J. Petrol. Tech.*, 1957, **9** (12), AIMME Tech. Paper No. 4694, 341–4.—It appears that the isothermal compressibility of medium to low specific gravity liq may be variable and both pressure- and temp-sensitive. The coeff is $c = \frac{1}{V}\left(\frac{\partial V}{\partial p}\right)_T$. This is approximately

$$c = \frac{2(V_1 - V_2)}{(V_1 + V_2)(p_2 - p_1)}$$

and the instantaneous compressibility is given by $c = \frac{\log_e \frac{V_1}{V_2}}{p_2 - p_1}$. The pseudo-reduced compressibility is given by $-c_r = \frac{1}{V_r}\left(\frac{\partial V_r}{\partial p_r}\right)_{T_r} = -\frac{1}{\rho_r}\left(\frac{\partial \rho_r}{\partial p_r}\right)_{T_r}$, where $V_r = V/V_c$, $\rho_r = \rho/\rho_c$ and $p_r = p/p_c$. Log/log plots of c_r against p_r for a series of hydrocarbon systems comparable with "reservoir oil," at constant values of T_r, give a straight line section which becomes longer as T_r increases, and then $A = c_r p_r = c_{L_1} p_1 = c_{L_2} p_2 = c_{L_3} p_3$, where the subscript L refers to single-phase undersaturated liq. Hence if the compressibility of such a liq has been measured at a fixed temp and a sufficiently high pressure (probably over 3000 p.s.i.a.) to be on the straight line sector, the pseudo-critical temp can be derived from the plot.

Published data have been used to obtain plots of log (bubble-point pressure at 60° F) against pseudo-critical temp for different sp. gr., and from these curves relating pseudo-critical temp and pressure with sp. gr. of undersaturated reservoir liq at reservoir pressure corrected to 60° F were obtained.

Specific gravities of oils may be obtained by pressure bomb surveys when oil is standing in the well.

Examples of the use of the curves and equations are given, and comparisons are made between the measured and calculated values for compressibilities.

The isothermal compressibilities are found to be pressure-sensitive. G. D. H.

1752. Detergent and citric acid aid input rates. R. T. Johansen, J. P. Powell, and H. N. Dunning. *World Oil*, 1958, **146** (1), 160.—Plugging of formations in water input wells can cause a gradual decrease in injection rates during water flooding; but under extreme conditions there may be complete stoppage of injection. Field tests have been carried out to study this type of well behaviour, and it has been found that the use of detergents and citric acid (to clean out the formation and to remove iron oxides and insoluble salts) is effective. Details of the tests carried out in Oklahoma are given, and it is concluded that mixtures of citric acid and non-ionic detergent were effective for increasing injection rates when proportioned into the wells under pressure. The rate increase was temporary, probably due to inadequate treatment of the injection water. C. A. F.

1753. New trends in treating waters for injection. J. W. Watkins. *World Oil*, 1958, **146** (1), 143.—Some of the latest developments in treating water for subsurface injection are described. There is more emphasis on more complete separation of oil from the produced oil–water mixture and the use, where possible, of closed injection systems. Organic treating chemicals are being used as biocides, corrosion inhibitors, and wetting agents, and the use of sequestering agents has been increased. Specific complexing additives are used to sequester or chelate some metallic ions. New methods for removing acidic gases dissolved in waters are being used, and these include "scrubbing" with combustion gases or natural gas in packed columns, the use of controlled aeration, submerged burners, and chlorination.

Improved chemical feeders and sedimentation tanks have been introduced and new types designed, and other developments include changes in filtration procedures and the use of automatic controls. 39 refs. C. A. F.

1754. Significance of the oil–water contact. F. W. Cole. *World Oil*, 1958, **146** (1), 174.—Although the term oil–water contact is commonly used in reservoir studies it is well known that there is no sharp line between the water and oil zones, but an exact definition of the term is required for calc of oil reserves, selection of well-completion intervals, and for general reservoir engineering studies. The exact meaning can vary from one company to another, and it is suggested that the best definition is that which states that the oil–water contact is the lowest structural position in the reservoir from which 100% oil can be produced. This point will be a function of relative permeability and capillary pressure, and the thickness of the transition zone can vary from only a few ft to several ft in thickness, depending on the wetting characteristics and the pore geometry of the pay. C. A. F.

1755. Determining the viscosity of crude. D. S. Davis. *World Oil*, 1958, **146** (1), 177.—A nomograph is presented which enables the visc of a gas-saturated crude oil to be estimated for pressures higher than the saturation pressure, the visc of the gas-saturated crude at the saturation pressure being known. The nomograph is based on data given by Burick and Beal. 2 refs. C. A. F.

1756. Calculation of the water-flooding of petroleum deposits in unidimensional approximation. (In German.) D. Marsal. *Erdöl u. Kohle*, 1957, **10**, 61–4, 141–6, 218–21.—Pt 1. Fundamentals. Essential basic formulæ are developed for linear flow—rectilinear flow through a const cross-section—radial, and *pseudo*linear flow—rectilinear flow through a changing cross-section—and applied to the evaluation of flooding experiments from consideration of a cyl rock body. These experiments are evaluated with regard to the inhomogeneity of the reservoir or analysis of the wells already flooding, which are not too close to the edge water. Observation of the permeability variation in this case is superfluous, since a flooding well automatically averages over the whole reservoir. Pt 2. Transfer of lab relationships to the field. The former actual cumulative production of a defined region—in which all wells produce essentially on the basis of edge water—subjected to edge water pressure influence, up to a definite moment, is taken from production reports. From the inundation degree of all wet oil-producing wells at the observed moment, and from results calc from formulæ already established (Pt 1), the position of the foremost water front is calc. From the extent of the region between the original edge water line and the foremost water front at the observed moment, also the calc deoiling curve, the oil vol which has been displaced theoretically by edge water or input water is determined. If this oil vol agrees satisfactorily at different moments, with the corresponding actual cumulative oil production of the region under pressure influence of the edge water, the results of 1 are reliable. If considerable variations arise, the region to be investigated must be divided into small strips for separate observation. Such an analysis, which explains the mechanism of oil displacement by water naturally, must be adjusted to the current special characteristics of the region. Pt 3. Well inundation. This section deals with the behaviour of an isolated well. Further, the fundamental relation between oil flow and oil saturation can be obtained from observation of inundating wells. If the results of Pts 1 and 2 are formulated, a calculation of the future development can be made, which gives a first survey on the given production policy for expected development, the attainable deoiling degree, and the dimensioning of the tech arrangements. R. T.

1757. Pozzolanic slurries for injection wells. W. F. Ball and K. A. Slagle. *World Oil*, 1958, **146** (2), 79.—Pozzolanic cement slurries used for injection wells in water flooding operations in the Kansas–Oklahoma area have had marked results, and a survey of over 100 wells has shown that they have many advantages, including lower pumping pressures, high fill-up without formation breakdown, and good bonding properties with pipe and formations.

The slurries consist of a mixture of Portland cement and a

pozzolanic material, of which there are 2 basic types: natural pozzolans, generally of volcanic origin, and artificial pozzolans, which are synthetic silicates, being the type generally used in the Mid-Continent. Properties of the slurry are discussed briefly with diagrams. C. A. F.

1758. How to boost production by removing water blocks. P. B. Burris. *World Oil*, 1958, **146** (2), 83.—The treatment of wells with a surface-active agent which reduces oil–water interfacial tension and breaks emulsions has often been the best solution for removing water blocks or visc emulsions which can reduce or even stop production. The treating solution usually applied consists of a 1% concn of the agent in kerosine or light crude oil. This is pumped into the formation at a rate of *ca* 2 brl mixture per ft of formation. Well shut-in time is from 12 to 24 hr. Cases of treatment are cited; in a Texas well producing from the Caddo limestone, emulsion removal by treatment with surface-active agents increased production by 30 b.d. A table shows results of treatments for 12 wells. C. A. F.

1759. Reservoir oil saturation with gas during pressure build-up. M. G. Cheney. *J. Petrol. Tech.*, 1958, **10** (1), 11–14.—If, in repressuring, gas goes into solution in the oil there will be increased effective permeability, decreased visc, and increased formation vol factor. Gas can go into solution readily when it occurs disseminated in the oil; low diffusion rates make for undersaturation on pressure build-up when there is no disseminated gas.

Tests in a sand-packed cell showed essential reversibility so far as gas solubility was concerned; equilibrium was rapidly attained.

The Socony Chimire 39R L — 2 M reservoir discovered in 1950 had 23% porosity, 1 Darcy permeability, and 20% water. Any initial gas cap must have been small (it could not have exceeded 39 acre-ft, the reservoir vol being apparently 9540 acre-ft). Primary depletion proceeded for 3½ years, pressure falling from 2360 to 1888 p.s.i.g. with extraction of $0{\cdot}73 \times 10^6$ brl of oil. Initial oil in place was calculated as $10{\cdot}1 \times 10^6$ brl ($10{\cdot}2 \times 10^6$ brl if no initial gas cap). No water drive was indicated.

Gas injection built up the pressure to 2060 p.s.i.g. in March 1955, and then the reservoir was shut in until Dec. 6 surveys indicated essentially constant average reservoir pressure during the period, pointing to no delay in resaturation. The observed pressures are in close agreement with volumetric balance calculations, assuming resaturation with gas, and well below those calculated assuming no gas solution on pressure increase. G. D. H.

1760. Fluid mechanics and hydrocarbon accumulations. A. Houpeurt. *Rev. Inst. franç. Pétrole*, 1957, **12** (12), 1219–23.—Oil is believed to be formed by anærobic bacteria from organic matter in the source rock, from which it is expelled by load and capillary forces into adjacent more porous rocks. In the latter it is surrounded by water and may rise by buoyancy when the oil mass attains a suitable height. This height is fixed by the densities of the oil and water, the interfacial tension, and the curvature of the menisci at the top and bottom of the mass.

$$\frac{2T}{r} = \frac{2T}{R} + hg(\rho_w - \rho_o)$$

where T is interfacial tension, r the radius of curvature at the top, and R that at the bottom.

In a reservoir with fissures the oil–water contact will be lower in the fissures than in the general porous mass.

For gas flow the low visc causes Darcy's law to be obeyed closely only some distance from the well, or when the rate of flow is very small. Liq closely obey Darcy's law. When there is 2-phase flow near oil–water or gas–oil contacts, or when gas has been liberated from solution, it is necessary to consider the relative permeability/saturation relationships. Invasion of mud filtrate involves similar factors.

Fluid injection may be undertaken to maintain pressure, thereby reducing the risk of the harmful effects of gas evolution. The short-circuiting of injected fluids through highly permeable zones should be avoided. G. D. H.

1761. The output of a well. J. P. Munier-Jolain. *Rev. Inst. franç. Pétrole*, 1958, **13** (1), 46–53.—For an aquifer the output of a well after the transient phase is of a *pseudo*-permanent nature, being in conformity with Darcy's law for radial flow, provided that certain conditions are satisfied; the bed is of constant thickness, the hole is circular, the well is at the centre of a circular reservoir with an impermeable boundary, and that there is no other producing well. The mode of completion is important. With perforations the output is affected by the number and penetration of any perforations. There may be original variations in the permeability of the rock, and those caused by the drilling and completion of the well, which give rise to the skin effect.

In the case of oil wells there are additional considerations. Any free gas or water present in the oil zone will reduce the effective permeability to oil. The aim should be to limit the evolution of gas in the neighbourhood of the well. However, in a water-drive field there may be greater oil recovery when a certain amount of free gas is present in the oil zone.

When there is gas above or water below the oil zone there may be a risk of gas or water coning. Restrictions on the section open to production may be necessary if certain producing rates are to be obtained without water or gas from the gas cap being produced. G. D. H.

1762. Study of the displacement of crude oil in porous media by the use of models. M. M.-J. Pagezy. *Bull. Ass. franç Tech. Pétrole*, Jan. 1958, 29–43.—Model studies can be interpreted quantitatively when proper attention is paid to the scaling factors. In addition, the use of transparent containers with glass as a sand and oil of the same refractive index permits details of the displacement of the oil by water or gas to be observed clearly. Linear water flooding was examined in a uniform sand and found to give 85% recovery at breakthrough and 88% recovery at 98% water cut when the oil and water had the same visc, but only 12% at breakthrough and 53% at 98% water cut for an oil/water visc ratio of 80; in both cases the recovery was much less when the formation was stratified.

5-spot secondary recovery was studied by similar means, injection being through the central well. The water front agreed well with theoretical predictions. Recovery was 68% at breakthrough for an oil–water visc ratio of 1, and 11% when the ratio was 80; at the economic limit the corresponding recoveries were 85% and 55%.

Dissolved gas drive gave 37% recovery for a linear system. Subsequent water injection gave an oil (with dissolved gas) bank, and a further oil recovery of 50%. G. D. H.

1763. Considerations on well diagraphy and on the evolution of electrical techniques. H. G. Doll. *Bull. Ass. franç. Tech. Pétrole*, Jan. 1958, 17–28.—The first log was made with an "inverse" or "lateral" device; it was good for correlation, not so good for identification of the nature of the rocks. The addition of S.P. logs in 1931 eased correlation and allowed recognition of permeable beds. The "normal" device appeared in 1932. In the period up to 1948 there was progressive introduction of means for obtaining several curves simultaneously and photographic recording; theoretical and experimental studies improved interpretation. Since 1948 there have been various devices to reduce the effects of the mud column–microlog, laterolog, microlaterolog, induction log. Other devices using electric cable are dipmeters, borehole surveying devices, thermometers, side-wall corers, per-

forators, radioactivity and neutron devices, fluid samplers, and seismic velocity measurers. Attempts are being made to measure porosities, while there are measurements of pressures and fluid flow.

For the filtrate-invaded zone the ratio of the water volume to the total volume is $(R_{mf}/R_i)^{\frac{1}{2}}$ and for the non-invaded zone the ratio is $(R_w/R_t)^{\frac{1}{2}}$ and the water saturation is $S_w = \frac{1}{\phi}(R_w/R_f)^{\frac{1}{2}}$, when ϕ is the porosity. The difference in water content of the 2 zones is a guide to the amount of oil recoverable by water drive. Measurement of R_t requires focused devices, of which the induction device is most important, especially with fresh water muds, provided the invasion is not too deep. The laterolog has focused current and can also yield R_t.

149 engineers are engaged on research and development in the Schlumberger group (48 on electrical diagraphy, 46 on other methods, 35 on testing and sampling), and each has at least 2 technical assistants. G. D. H.

1764. Completing high-pressure wells. M. J. Epperson. *Petrol. Engr*, 1958, **30** (3), B53–70.—Most failures of deep, high-pressure wells have been due to the failure of tubing or casing attributable to design errors or abuse during operations. Methods of selection and design of tubular goods for high-pressure use are given. Methods of corrosion control using inhibitors, plastic coatings, and corrosion-resistant materials are outlined. Improved manufacturing standards and better use of tubular goods are reducing failures. 13 refs. A. E. R.

1765. Evaluate perforating effectiveness. Anon. *Petrol. Engr*, 1958, **30** (3), B72–8.—The simulation of downhole conditions of up to 190° F and 1500 p.s.i. have produced improvements in perforating and shown the value of using a completion fluid in the hole while perforating. Permeability of core targets determined before and after perforation enables results to be compared. Studies showed that a pressure differential into the well bore while perforating gave improved results. A. E. R.

1766. Centralia water flood: pre-planned automation pays off. K. W. Foster. *Petrol. Engr*, 1958, **30** (3), B116–22.—A water flood system of 112 producing and 97 injection wells, highly instrumented to enable remote reading of meters and ease of control, increased oil production from 230 to 5000 b.d. in a year. Injection water is obtained from deep wells and contains hydrogen sulphide, which is removed in stripping towers. Oil and solid particles are removed in settling tanks and filters. The quality of the water is automatically controlled, and the treating rate adjusts the injection rate to the water-treating plant. 2 high-pressure vertical turbine pumps, each of capacity 20,000 b.d. at 825 p.s.i., are used for water injection. A. E. R.

1767. Deep wells increase 28%. E. Adams. *Petrol. Engr*, 1958, **30** (3), B21–30.—In 1957, despite a decrease in total drilling activity, 199 holes were drilled below 15,000 ft in the U.S.A., representing a substantial increase. 119 deep wildcats were drilled, 60 of which discovered new fields, new sands, or extended fields. Average drilling time/well increased, but with the improvement in bit quality the number used has declined. A. E. R.

1768. Discussion of reservoir characteristics, Cedar Creek anticline fields, Montana. A. Hols and F. T. Bethel. *J. Petrol. Tech.*, 1957, **9** (12), 23–30.—The Cedar Creek anticline fields produce from Mississippian and Siluro-Ordovician rocks. The latter reservoirs vary laterally and vertically, the degree of dolomitization controlling the porosity and permeability. Logging generally involves laterolog with S.P. curve, microlaterolog, and neutron γ-ray log.

In order to facilitate interpretation of conventional core analyses on field-wide bases, punched cards are prepared on every analysis, thus allowing rapid statistical correlation. An IBM 650 computer is used. Permeability/porosity trends have been determined, and permeability/cumulative void vol plots have been made. Average porosity ranges 7–17%. All the producing zones are of relatively low permeability and moderate porosity (excluding fractures, which are generally believed to be of minor importance).

The Red River formation of the Cabin Creek field is the only one for which there is a satisfactory amount of capillary pressure data. Using a cut-off of over 400 p.s.i. at 50% saturation, it seems that very few cores with less than 10% porosity would be classed as productive, and 40% of the 10–15% group would be in the same class.

Formation visc are usually 1–2 cP. There is often much nitrogen gas with the crudes. The highest concn of nitrogen have been found in zones directly overlying basement and below all possible hydrocarbon source beds. Migration upwards via faults is suggested, and this agrees with vertical similarity of crudes in a field, although they vary laterally.

Variations in water salinities from 10,000 to 200,000 p.p.m. may be due to imperfect flushing. Free salt in the crude ranges 40–400 lb/1000 brl.

There is a continuous drop in water level from S. to N. along the Cedar Creek anticline. The overall drop is similar to the 20 ft/mile plunge of the anticline. Initial pressures are slightly above hydrostatic. The dominant production mechanism is depletion-type; there is some water-drive, which increases from S. to N. G. D. H.

1769. Clay content and capillary behaviour of Wyoming reservoir sands. O. C. Baptist and E. J. White. *J. Petrol. Tech.*, 1957, **9** (12), 57–9.—Samples of the Second Frontier, Newcastle, Tensleep, and Lower Muddy sands were studied, since they differed in the amount and nature of their clay content. Air and fresh water permeabilities were measured. Capillary pressure measurements were made with mercury, fresh and salt water, and imbibition tests were made using water and kerosine.

For sands with considerable amounts of high-swelling clay, gas permeability was much higher than water permeability, irreducible water saturations were usually high, and water was imbibed to high saturations. These effects were less marked when non-swelling clays were present, but greater than for clay-free sands.

Water-displacement and mercury injection tests give comparable results for relatively clay-free sands, but there is a marked difference when clay is considerable in amount. Irreducible water saturations were independent of water salinity; probably most of the water is held on surfaces and in fine capillaries, not in inter-layer positions. Preferential wettability is sometimes important in capillary behaviour. G. D. H.

1770. Madison block flood in Mid-Continent outstanding. R. L Higginbotham and J. J. Williams. *World Oil*, 1958, **146** (1), 166.—The Madison block water flood project has been one of the most successful in the Mid-Continent area. The field is located in Greenwood County, Kansas, and the project was started in 1948; production has risen from 150 to 1400 b.d.

The field was found in 1923, and approx 132 producers have been completed within the field area covering some 1400 acres. Pay is Bartlesville sand, which is lenticular, and production was by primary methods until 1932, when gas injection was started. Production before gas injection was 5,806,912 brl, and increased production due to repressuring over a 20-year period, until 1952, was 1,475,417 brl. When water injection was started in 1948 production had declined to 200 b.d. Water input well spacing on 20 acres has been used, and from 1950 production increased steadily to a peak of 2100 b.d. in

Dec. 1955. Current production is 1400 b.d. from 62 wells, and the future life of the flood is estimated to be 5 years.

Details of the flood system are given, together with data on the water treating system, the conversion of wells, modernization of producing equipment, and operating problems. Each input well has a throttling type valve and a water meter, so that each can be operated with efficiency. Diagrams show the water treating system and performance curves of the project. C. A. F.

1771. Will shaly sands respond to water flooding? N. S. Morrisey. *Oil Gas J.*, 7.4.58, **56** (14), 168–9.—Deep Fork field in Creek County, Oklahoma, has produced since 1919 from the tight shaly lower Skinner sand. Water injection was begun in 1953. To-day there are 36 oil wells and 38 injection wells on a 5-spot pattern, each oil well producing from 40 acres. 11 water wells provide 12,500 b.d. water. Producing wells are normally fractured, and production is now 1100–1200 b.d. oil and 3600 b.d. water. J. C. M. T.

1772. New solution proposed for dual completions in Citronelle field. H. G. White and R. C. MacElvain. *World Oil*, 1958, **146** (2), 74.—Completion practice in the Citronelle field, Alabama, involves dual completion of deep producing zones, the upper occurring at 10,850–11,000 ft, with up to 7 sands, and the lower at 11,250–11,500 ft, also with up to 7 sands. The zones are separated by dense shale with sand streaks. Single zone completions on the adopted 40-acre spacing are impracticable, and there has been a problem in finding an efficient dual completion method. The current methods used are very costly, and the conventional methods require 2 strings of rods and 2 pumping units. A new method is proposed to overcome the problem, and this involves a single tubing string with one-way valves which will permit production from upper and lower zones to commingle without the risk of return flow to formation. Diagrams show various types of well completion at Citronelle. C. A. F.

1773. Performance of the Sussex area Tensleep reservoirs. T. R. Blevins. *J. Petrol. Tech.*, 1958, **10** (1), 19–23.—The Sussex field, discovered in 1948, has 3 separate producing areas, with over 350 producers obtaining oil from 7 horizons at 3000–9200 ft. The first Tensleep discovery was in June 1951. The Tensleep A unit has 9 open-hole completions on 40-acre spacing; the Tensleep–Amsden B unit has 26 wells on 40-acre spacing; 13 wells have been completed in the Meadow Creek Tensleep unit. The oil–water contacts differ.

The Tensleep, at *ca* 9000 ft, consists of fine- to medium-grained dolomitic sandstone; average permeabilities are 55–87 mD. Dips differ in the units, the max being 12·8°.

To July 1957 the A unit had given 1,903,034 brl of oil (16·9% recovery), the B unit 4,031,914 brl (5·3% recovery), and the Meadow Creek unit 3,335,436 brl (9·7% recovery). The A unit seems to have limited water drive, and bottom-hole pressure has stabilized during the last year. The B unit seems to be produced dominantly by fluid expansion; faulting may have precluded an active aquifer. The Meadow Creek unit has a strong water drive. Ultimate recovery may be 28% for the A unit and 35% for Meadow Creek; a peripheral water flood may bring the B unit recovery to 30%

All the Tensleep wells are fitted with 456,000 inch-lb air balance pumping units: all wells but one have 120-inch stroke and 10 strokes/min. The pump depths are 3000–9200 ft. G. D. H.

1774. Oilfield injection. Anon. *Fluid Handl.*, 1958, 126.—Description of film showing world's first Al oilfield water-injection line in Alberta. Water from N. Saskatchewan River is filtered and pumped through 6-inch Al line at 500 p.s.i.; 4-inch branch lines terminate at several injection wells. Main advantages of Al pipe are corrosion resistance and ease of handling. W. A. M.

1775. Diminution of pressure in the course of exploiting the Saint-Marcet gas accumulation. J. P. Verrien. *Rev. Inst. franç. Pétrole*, 1958, **13** (1), 54–70.—Relationships can be derived which describe the equilibrium distribution of mixtures of hydrocarbons between the liq and gaseous phases as a function of temp, pressure, and composition. For natural gases the heavier components occur in small amounts, and it is possible to consider the mixtures as *pseudo*-binary, methane being the main component. Many accumulations, although near the critical point, are in a condition under which there is some liq phase present. A fall in pressure due to extraction of gas leads to separation of liq.

Production data permit calculation of the original vol of reserves, but if the figure so obtained diminishes in the course of exploitation there may be water advance.

However, diminution of pore space may be due to other factors also: rock compressibility, interstitial water compressibility, and condensation of liq hydrocarbons. At Saint-Marcet a pressure drop of 70 kg/cm² would cause pore diminution to 200,000 m³ on a total vol of 44×10^6 m³; 30% of interstitial water would expand by 60,000 m³; condensate deposited might be 220,000 m³. These vol are small compared with water advance.

The Saint-Marcet structure has 22 wells. A plot of pressure *v.* cumulative output shows a break at 136·5 kg/cm². Up to this point the vol calculated from the data are constant, and they allow estimates of later water invasion to be made. At the end of 1956 this was *ca* 2×10^6 m³. The aquifer vol is $1{\cdot}04 \times 10^9$ m³. G. D. H.

1776. Maintenance of salt water disposal lines. B. G. Cunningham. *World Oil*, 1958, **146** (2), 77.—Partial plugging of disposal lines by scale deposited from produced brines is a problem in many oilfields, but a treatment involving chemical cleaning has been successfully used. The method consists of applying acid solvent in stages, the complete operation taking usually only 4–6 hr. Details of the technique are given for conventional transit disposal pipe; the approx amount of scale to be removed being calc in advance knowing the average thickness from a sample. The best cleaning procedure can then be determined knowing the type and amount of acid solvent required. A few case histories are briefly given; in one example a 1000-ft line was cleaned with 500 gal of 15% acid solvent at a cost of *ca* $400, the line being out of use for only 4 hr. C. A. F.

OILFIELD DEVELOPMENT

1777. Offshore oil to be sought on U.S. side of Lake Erie. H. T. Brundage. *World Oil*, 1958, **146** (1), 74.—Offshore development in Lake Erie is planned by U.S. operators, and leases have recently been awarded. Max depth of water in the lake is reported to be 210 ft, and most of it is much shallower, so that existing techniques can be used for drilling and development. Cable tool drilling will probably be used with rigs supported on temporary steel platforms. Seismic work may be carried out after necessary permits have been obtained, and potential pays include the Ordovician Trenton limestone and the Devonian Oriskany sandstone. Producing wells will be completed and connected to pipelines as near as possible to the lake floor for reasons of navigation. C. A. F.

1778. Canada has good year. H. G. Cochrane. *Petrol. Engr*, 1958, **30** (3), E1–4.—Expansion of the Canadian oil industry decreased in 1957 compared with recent years. Oil production was 183 million brl, a 7% increase over the previous year. Development drilling declined, but a record number of wildcats was drilled, of which *ca* ⅓ were successful. Geophysical activity was maintained, and oil exports increased in spite of unfavourable market conditions. Refinery capacity rose to 774,550 b.d., with less emphasis on cat cracking. The pipeline industry constructed 800 miles of crude lines, 2000 miles of gas lines, and 2500 miles of distribution lines. A. E. R.

1779. New Alberta production area. Anon. *World Petrol.*, 1957, **28** (13), 8.—A pipeline is being built to tap the Innisfail producing area, 60 miles N. of Calgary, Alberta, which is a new producing area with estimated reserves of approx 50 million brl. Production is from the Devonian reef limestone. The pipeline will intersect existing lines to the Edmonton terminals of Trans-Mountain and Interprovincial pipelines.
C. A. F.

1780. Alaskan oil search grows. T. Dougherty. *World Petrol.*, 1957, **28** (13), 45.—Many companies are now searching for oil in Alaska with leases covering over a million acres. There are *ca* 175,000 sq. miles of favourable territory, and current activity is centred in 3 general areas, the Katalla–Yakataga area at the N. end of the Gulf of Alaska, the Kenai peninsula on the E. side of the Cook Inlet, and the Koyukuk basin W. of Fairbanks in central Alaska. Other areas of interest include the Iniskin peninsula and the Wide Bay area on the Alaska peninsula.

The history of oil development in the country is outlined, and details of current activity given. Of particular interest is the Koyukuk basin in the interior, where a well is to be drilled following ground and photogeological surveys. Surface geology has indicated a reversal of 4000 ft involving Cretaceous beds. The basin contains sediments up to 25,000 ft in thickness, the upper 7500 ft being considered favourable for oil and gas. This will be the first important oil investigation of the interior of the country.

Oil operations are carried out under rigorous conditions, and special techniques have had to be introduced because of the cold climate; a map shows the major oil company leaseholds in Alaska.
C. A. F.

1781. Crisis in Cuba. E. Copeland. *World Petrol.*, 1957, **28** (13), 60.—Some 8 oilfields have been discovered in Cuba, of which 5 have been found during a moderate oil boom which started in 1954. In spite of the fact that exploration has been intensified in recent years, oil development in the country has reached a crucial stage because the Government has not clarified certain aspects of the existing oil laws, involving the legal position of state reserves. Leases have recently been passed to larger companies, who are now seriously evaluating the island, and during 1958 they will drill several deep tests. Cuba produced 57,163 brl in 1954, and this increased to 543,121 brl in 1956.
C. A. F.

1782. Drilling and exploration to increase in Cuba. Anon. *World Oil*, 1958, **146** (1), 179.—Important oil developments in Cuba are planned; these include test drilling with an offshore well, and considerable exploratory work. To date 6 producing fields have been found in Cuba, 5 of which are producing from serpentine at fairly shallow depths. The Jatibonico field alone produces from a sedimentary formation.

Recent developments include the completion of another well in the Bacuranao-Cruz Verde field, near Havana, reported to have flowed *ca* 300 b.d., and the drilling of a third well at Catalina near the Jatibonico field. Some of the major companies who recently acquired interests are carrying out exploration prior to selecting acreage for development work and conversion into concessions.
C. A. F.

1783. New deep field discovered in Venezuela's Zulia state. Anon. *World Oil*, 1957, **145** (7), 194.—Well CR 4 in Zulia, Venezuela, is reported to have tested 2000 b.d. of clean 39° oil from the Cretaceous at *ca* 14,100 ft, finding a new deep field. A new road is being built in the area in the SW. part of the state near the Colombian border in order to facilitate exploration in this area.
C. A. F.

1784. Oil hits peak in Colombia. E. Ospina-Racines. *World Petrol.*, 1957, **28** (13), 38.—Oil output from Colombia is currently *ca* 123,950 b.d., 33·2% being produced by Shell, and drilling and exploration have reached a new peak level, stimulated by exchange benefits and new legislation. Wildcatting now being carried out promises to increase production further and to offset the decline in production from older fields. Total number of fields in the country is 22, and a table shows their individual importance. Other tables show statistics of drilling and production, and a map of current and prospective drilling and locations is included.

Total land holdings of operators and independents cover some 27 million hectares, and these include applications for concessions, firm concessions, and private properties with recognized oil titles. A government depletion allowance was granted for the industry in 1955; oil contributed 6·3% of the total dollar exchange acquired by Colombia in 1956.
C. A. F.

1785. Brazilian exploration rises in 1957. R. G. Walker. *World Petrol.*, 1957, **28** (13), 55.—Exploration in Brazil continued at an increased rate during 1957, and 15 geological, 15 seismic, and 8 gravimetric teams were operating. Discovery rate was better in 1956 than in the previous years, 68% of the wells drilled being producers, with exploration extending W. from Manaos towards the Peruvian border and S. to Santa Catarina and Rio Grande do Sul. Although it is expected that oil will be found in commercial quantities in the Amazon basin and Alagoas, the only productive area is still the Bahia Reconcavo. Production from this area in 1956 was 4,058,703 brl (or 11,197 b.d.).

Recent exploration in several areas of Brazil is outlined, the Amazon basin being the area of greatest activity. Oil and gas shows were found in a wildcat on Marica island, at *ca* 9000 ft. A table shows Brazilian wildcat drilling as at July 1957.
C. A. F.

TRANSPORT AND STORAGE

1786. Vertical pumps—finding many new process applications. J. P. Cannon and J. A. Lindquist. *Chem. Engng*, 1958, **65** (5), 139–42.—New centrifugal pumps designed for vertical operation are now manufactured specifically for process industry use in the U.S.A. Advantages claimed for them include: (1) safety in emptying tanks—no bottom outlet or air pressure needed; (2) no stuffing box leakage—seal never contacts the liq pumped; (3) self-venting; (4) self-priming; (5) self-draining. Uses include unloading tank cars without using an unloading station or a bottom outlet. Main snags are increased initial and maintenance costs compared with horizontal pumps.
P. J. O.

1787. Bolted clean-out doors for your tanks. R. W. Bodley and R. C. Ulm. *Petrol. Refin.*, 1958, **37** (3), 213–18.—This article discusses bolted door sheets which have been developed because of the need for a large, safe, economical clean-out door that could be removed and replaced by regular maintenance personnel. The design of these bolted doors is discussed in some detail, and data for both "raised" and "flush" types are presented in tabular form. Several tests carried out showed that application of a coating of neoprene produced the most efficient seal.
J. R. T.

1788. World tanker statistics, 1957. Anon. *Inst. Petrol. Rev.*, 1958, **12** (136), 124–5.—Figures are given for: (1) the registration of tankers launched in 1957, including tonnage; (2) oil tankers of 100 tons and upwards launched in 1957; (3) those under construction at end of 1957.
E. M. I.

1789. The Monitron—a B.S. and W. instrument for precision dielectric measurements. Anon. *Pipe Line News*, Dec. 1957, **29** (12), 22–4.—This is a monitor to prevent a line fill of unsaleable oil, *i.e.* containing more than 0·5% basic sediment and/or water. To allow for short runs which exceed this limit without making the whole line fill unsaleable, a continuously variable time delay is incorporated. The instrument, which works on measurement of the dielectric constant of the fluid, is excited by a 3·8-megacycle frequency. The readings are given directly in terms of B.S. and W. percentage. Details of the specification and performance of the instrument are given, and among the special features mentioned are the time delay, fail-safe device, defeat switch, gas-air shut down, damping, and built-in calibration check. A continuous recorder can be used, and the basic units needed with the Monitron are the probe, R.F. unit, and power supply.

D. K. R.

1790. Gas load control through telemetering. R. D. Hays. *Pipe Line News*, Feb. 1958, **30** (2), 46–51.—In order to allow gas utility companies to estimate the fluctuations of demand and to take the necessary action to prevent gas loads exceeding the " penalty " limit, flow telemeters are being introduced and used in conjunction with totalizers. The integrated data may be transmitted by microwave to the central control point from various local stations, so that an overall picture of gas load may be produced and adjustments made where necessary. This system is also useful in that it shows plainly burst mains and other large leaks. Accuracy checks are made frequently by comparing the telemetered results with those of the pipeline. An example of this type of control is given, with a diagram of a typical border station installation and its connexion to a microwave station. D. K. R.

1791. Greater research from LACT. H. L. Shatto and A. H. Hall. *Oil Gas J.*, 7.4.58, **56** (14), 133.—Present status is reviewed of Lease Automatic Custody Transfer usage, likely trends for technique advancement and need for pipeline leadership and a policy to encourage early realization of the potential benefits to the industry are outlined. G. A. C.

1792. Crude trunk line brings more market for oil. W. Quarles. *Pipe Line News*, Dec. 1957, **29** (12), 34–9.—Four Corners Pipe Line Co.'s new $50 million crude trunk system, which will bring oil from the San Juan and Paradox basins to the refineries in the Los Angeles area, has caused a greatly expanded exploration programme in the basins. Proven crude reserves, already at 250 million brl, are expected to top 500 million brl. The line, which is jointly owned by 6 of the major oil companies, is being constructed in 9 sections, 4 of which have been completed, and the remainder are under construction. The completed sections are being tested and partially filled. Mention is made of some of the constructional problems, and the methods being used to tackle them.

D. K. R.

1793. The James Clayton Lecture (Large pipeline projects). A. C. Hartley. *Petrol. Times*, 9.5.58, **62** (1585), 395.—Deals with advances in development of pipelines, corrosion, large dia pipelines, and communications in connexion with pipelines. G. A. C.

1794. Economics of pipelines. R. Cabet. *Bull. Ass. franç. Tech. Pétrole*, 1958, 155–78.—After a brief historical introduction, pipeline systems for crude oil and finished products in the U.S.A., France, Sahara, and the Middle East are described with maps. In general, large pipelines offer the most economical means of transporting oil; reasons for this are examined. The final section reviews factors affecting pipeline costs. Graphs and formulæ are given for calculating costs, and it is shown that for a given throughput there is an optimum dia.

W. A. M.

1795. The different formulæ for pressure drop in pipelines: application to the Le Havre–Paris pipeline. J. B. Capdeville. *Rev. Inst. franç. Pétrole*, 1958, **13** (1), 71–82.—Prediction of pressure losses in pipelines is important if they are to be designed efficiently. For an incompressible fluid the pressure loss, expressed as height of liq, is $J = \frac{\lambda}{D} \cdot \frac{V^2}{2g}$, where λ is the friction constant, which is a function of the Reynolds No. (R) and the relative rugosity $\left(\frac{\epsilon}{D}\right)$. Nikuradse found for streamline flow that $\lambda = 64/R$ in accordance with Poiseuille's law. In the transition region Blasius formula was satisfied: $\lambda = 0{\cdot}3164\ R^{-\frac{1}{4}}$. Beyond a second critical point Nikuradse proposed $\frac{1}{\sqrt{\lambda}} = 2 \log 3{\cdot}7 \frac{D}{\epsilon}$. Colebrook and White have proposed to replace Blasius, and von Karman's relationships by $\frac{1}{\sqrt{\lambda}} = -2 \log \left(\frac{\epsilon/D}{3{\cdot}7} + \frac{2{\cdot}51}{R\sqrt{\lambda}}\right)$.

Experimental studies were made on 10-inch pipe to be used for the Le Havre–Paris products line with throughputs of 180–270 m³/hr. It was concluded that the various formulæ must be rejected and use made of the Hydraulic Institute tables and curves, based on White and Colebrook's results; these seem to apply best to commercial steel pipe. The new tubes used in the tests had relative rugosities of 0·0002, tending to 0·0001 for refined products after a certain time of use of inhibitors and scrapers.

The evolution of the coeff C in the Hazen–Williams formula for the pipeline over time with change in procedure is displayed. G. D. H.

1796. Tube for pipeline. G. Marelle. *Rev. Inst. franç. Pétrole*, 1957, **12** (12), 1224–35.—Pipelines installed and the prospect of others to be built call for a full study of many points if the projects are to be economically and technically satisfactory.

The API has set up specifications which cover the dimensions, types of steel, and working pressures for tube for pipelines. Tables give the dimensions of tubes and the mechanical characteristics of the steels, and formulæ relate wall thickness, dia, max working pressure, max admissible stress, and allowance for corrosion.

The ends must be properly formed for welding. Tubes have to be tested hydraulically. They must be properly marked.

The manufacture of weldless tubing is briefly described, together with the inspection of the products.

The French steel tube industry is in a position to provide pipe for various oil development projects which are in hand.

G. D. H.

1797. Gas turbines in the desert. W. E. Locker, A. E. Olson, and P. P. Nibley. *Mech. Engng, N.Y.*, April 1958, **80** (4), 81–4; *Oil Gas J.*, 7.4.58, **56** (14), 125.—6 new pumping units have been installed by Tapline, driven by 5000-h.p. General Electric combustion gas turbines. 3 of these are unattended units, and 3 permanently installed at the existing stations. The unattended unit operates at 110° F and 2600 ft elevation, is fuelled by crude taken directly from the pipeline, is radio-controlled from 50 to 100 miles away, and is portable. Diagrams of the turbine van, control van, and control system, together with descriptions of these, and of the radio van and their maintenance are given. Aramco has 2 similar units. 1 ref. E. M. I.

1798. Electrical insulation of underground pipelines. Pt 3. G. B. McComb. *Petrol. Engr*, 1958, **30** (3), D42a–5.—Moisture tests of soils and coating systems used for the protection of underground pipelines against corrosion are outlined. Prolonged tests under service conditions show that coal-tar coatings have a long life and low water absorption, and that

no oxidn or chemical change occurs. Asphaltic coatings usually require more current for cathodic protection than coal-tar coatings, and corrosion occurs in places where there is no bond between the asphalt and pipe. A. E. R.

1799. The story of Westcoast, Canada's first major gas line. Anon. *Pipe Line News*, Feb. 1958, **30** (2), 24–45.—The history of this 560-mile gas pipeline running from Taylor, British Columbia, to Sumas, on the international border, is given from its original conception over 20 years ago until the present day, when an average throughput of 300 M.M.c.f/day is maintained. Description is given of the many legal difficulties which had to be overcome and agreements which had to be concluded while getting Westcoast incorporated as a special act company, and obtaining permission to take gas out of the states producing it as well as permission to build the pipeline and to export surplus gas to American markets. With the legal side settled, construction commenced in 1956. The route was divided into 4 schedules of 120, 210, 210, and 110 miles, each given to a different contractor. Mention is made of the route, the obstacles encounted, and the methods of construction used. When the line was completed it was tested by water, gas, or air, according to the availability of gas and the characteristics of the section. Test pressures of up to 1130 p.s.i.g. were used and maintained for 24 hr, although the pipe operates at a max pressure of 886 p.s.i.g. The gas produced from most of the British Columbian fields contains H_2S and liq hydrocarbons, which have to be removed before the gas is piped. The gas is processed at the McMahon plant at Taylor, British Columbia, and the scrubbing plant is the foundation for many petrochemical enterprises. The liq hydrocarbons removed from the scrubbing plant are made into regular refinery products at an adjacent refinery, and the H_2S is reduced to elemental sulphur at a third plant near by. Details of the 3 plants and their operation are given; of particular interest are the design details of the plants which have to be able to stand the severe winter conditions. To transport the full capacity of 660 M.M.c.f/day, through the 30-inch pipeline, 8 compressor stations will be installed at *ca* 80-mile intervals along the line, having a combined output of *ca* 185,000 h.p. At present 4 stations of total output 52,500 h.p. allow a throughput of 400 M.M.c.f/day. Details of the location of these stations and the equipment used in them are given, with special mention of the specifications and control procedures of the gas engines driving the compressors. Mention is made of the gathering system used to bring gas from the various fields in Alberta and British Columbia to No. 1 compressor station on the line, and some of the problems introduced by " sour " gas from the British Columbia fields and the extreme weather conditions are given. D. K. R.

1800. Colombia's pipeline network expanding. W. Bellon. *Petrol. Engr*, 1958, **30** (2), D20–3.—The pipeline system existing in Colombia is described. Crude oil capacity is 227,100 b.d., refined products 120,700 b.d., and new projects are planned, including the transport of LPG. A. E. R.

1801. Texas Eastern's gas turbine compressor stations. E. Sterrett. *Pipe Line News*, Dec. 1957, **29** (12), 25–33.—Where economic and design considerations indicate their suitability, Texas Eastern Transmission Corpn use gas turbines running on natural gas to drive the pipeline compressors, instead of relying on local electricity supplies. 2 stations using gas turbines are the one on the 30-inch line at Athens, Ohio, and that at Grantville on the 24-inch line from Oakford to Eastern delivery points. The former station uses two G.E. gas turbines, each rated at 7600 h.p., with Clark centrifugal compressors, while the latter has one 5000-h.p. Westinghouse gas turbine connected to a Cooper–Bessemer single-stage centrifugal compressor. This unit has lately been doubled up. Piping diagrams for the Athens station and the Grantville station before modification are provided, together with comprehensive data about costs and equipment employed in both stations. It is pointed out that very little more aux equipment is needed for the 15,000-h.p. station than for the 5000-h.p. one D. K. R.

1802. Floating plastic bags to chop barging costs. C. S. Cronan. *Chem. Engng*, 1958, **65** (5), 82.—The use of plastic bags holding up to 20,000 gal of chemicals or fuel oil is briefly described. Kept afloat by air in sealed compartments, they can be towed in line like barges, and have already been demonstrated in Germany. The empty bags can be returned to the supplier very cheaply, or discarded after use. P. J. O.

1803. Costs of horizontal mild-steel drums with domed ends. Anon. *Chem. Proc. Engng*, 1958, **39**, 167–9.—Graph is presented showing cost in £ at Dec. 1957 of horizontal mild steel drums with dished ends, capacity 250–12,000 gal, wall thickness $\frac{3}{16}$–1 inch, against wt in tons. By subtracting cost of steel, fabrication cost is obtained (this includes overheads and profits), whence is derived curve showing fabrication cost in £/ton. Tables are given of dimensions, capacities, and approx wt of mild steel horizontal storage tanks with dished, flanged, and unflanged ends to BS 2594 : 1955. W. A. M.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

1804. How to design finned tube and shell heat exchangers. Pt 3. E. H. Young and D. J. Ward. *Petrol. Engr*, 1957, **29** (13), C18–24.—Design equations for heat transfer during heating or cooling, using finned tubes, are given and a liq–liq cooler problem is worked out. A comparison is made between the cost of a finned tube exchanger and a conventional type. 14 refs. A. E. R.

1805. Let computers pick your exchangers. R. E. Githens, Jr. *Chem. Engng*, 1958, **65** (5), 143–6.—Most heat exchanger calculations involve complex but repetitive arithmetic, which can be done most quickly and cheaply by digital computer. Methods of programming are described. The machine can obtain many solutions to a problem, so that the optimum one may be chosen, instead of the first usable result of calculation, resulting in optimum performance at minimum outlay. P. J. O.

1806. How gasoline plants are using gas chromatography. A. J. Miller. *Oil Gas J.*, 3.3.58, **56** (9), 88.—Phillips Petroleum Co. have used gas chromatography to observe effects of small changes in operating variables and conditions such as weather temp in order to maintain plant recovery efficiency. Studies of absorber and de-ethanizer units and other streams were made. G. A. C.

1807. Equipment costs continue upward. Anon. *Chem. Engng*, 1958, **65** (4), 143–4.—The rise in equipment costs in petroleum and allied industries is shown graphically up to the end of 1957, chemical, rubber, and other industries being treated separately. P. J. O.

1808. Design for low construction costs. R. C. Rohrdanz. *Chem. Engng*, 1958, **65** (6), 133–7.—The principal factors affecting construction costs are discussed, together with methods of minimizing each. Types of contract, methods of

estimation used by contractors, piping and foundation costing, and rigging costs are all dealt with in detail.
P. J. O.

1809. French petroleum equipment materials. G. Henry. *Bull. Ass. franç. Tech. Pétrole*, 1958, 93–108.—Review of constructional materials used in petroleum refining, drilling, and exploration, with particular reference to French production thereof. Tables are given of French equiv of ASTM carbon steels for sheets. W. A. M.

1810. Esso Research semi-automatic pilot plant. Anon. *Fluid Handl.*, 1958, 97–8.—Esso Research (U.S.A.) will install in 1958 a computer-controlled pilot plant for evaluation of cat processes. Features include automatic analysis of product streams by gas chromatographic and other methods, control of operating variables, and evaluation of results by the computer. Advantages over conventional pilot plant are greater accuracy and speed. W. A. M.

1811. Radioisotopes in petroleum refining. W. H. King. *Industr. Engng Chem.*, 1958, **50** (2), 201–4.—Some of the uses to which radioisotopes, especially the gamma emitters, can be put in a refinery are mentioned. Isotopes with long half-lives are principally used for density measurements; those with short half-lives as tracers. A list of the isotopes most often used by refiners, and the processes which they are used to investigate, is given. The advantages of radioisotopes are their convenience and economy, as jobs previously impossible can be tackled and only very small quantities of tracer are required. Descriptions are given of the techniques for quantitative γ-ray absorption for density measurements, and tracer applications in refining, such as estimation of mixing efficiency in both batch and continuous processes.
D. K. R.

1812. Flares and blowdown systems. L. Resen. *Oil Gas J.*, 12.5.58, **56** (19), 123.—Esso uses non-luminous flares and liq blowdown systems incorporating by-passes direct to storage facilities at its Baton Rouge refinery. G. A. C.

1813. Gas pulsations. E. N. Henderson. *Oil Gas J.*, 12.5.58, **56** (19), 115.—A summary is given of the Southern Gas Association's pulsation research project, which concerned cause and effect of gas pulsation. Examples are given of how pulsations affect compressor stations. As a result of the investigation, several new principles in acoustics and piping design have been discovered and developed, whilst known principles have been expanded and improved. G. A. C.

1814. Plastics in refining and petrochemicals plants. R. B. Seymour. *Petrol. Engr*, 1958, **30** (2), C46–52.—Characteristics and suitable applications of plastics in the construction of refinery and chemical plants are listed. Applications of plastics are increasing in the U.S.A., due to an improvement in production techniques and the development of manufacturing standards. A. E. R.

1815. Cartagena refinery: the new look in overseas plants. J. H. Baumgartner and A. Donado. *Petrol. Engr*, 1958, **30** (2), C7–9.—A new refinery in Colombia to accommodate the growing demand for petroleum products is described. The refinery was designed to process 26,500 b.d. of either light or medium-heavy crudes. The preheated crude passes through a 2-stage crude dist unit. Gas oil with recycle stock is fed to a fluid cat cracker designed to process 13,130 b.d. of fresh feed.
A. E. R.

1816. Mina al Ahmadi refinery. Anon. *Fluid Handl.*, 1958, 127–31.—Original crude oil 30,000 b.d. atm dist unit has been supplemented by 2 new units each of 80,000 b.d. with gasoline stabilizer. Construction and operation of the new plants are described, also ancillary services, including new tankage, power plant, water supply, etc., and additional pier and submarine loading facilities. Cost of expansion programme was £14 million. W. A. M.

1817. Isle of Grain (Kent) refinery. Anon. *Fluid Handl.*, 1958, 65–70.—22 new units will be erected in BP's £30 million expansion programme at Isle of Grain to increase overall production, and manufacture aviation spirit. Lists of contractors and new units are given. Welding of tanks and columns is described. W. A. M.

1818. Finland's first refinery. Anon. *Petrol. Times*, 9.5.58, **62** (1585), 391.—A short description is given of the refinery at Naantali, which has a capacity of about 450,000 metric tons p.a. G. A. C.

DISTILLATION

1819. Figure flash equilibrium easier, quicker this way. F. J. Lockhart and R. J. McHenry. *Petrol. Refin.*, 1958, **37** (3), 209–12.—A method of making flash equilibrium calculations for multi-component mixtures is presented. This method, which reduces a multi-component mixture to a hypothetical binary system, has several advantages over other methods. It is accurate, bracketing the correct result on the first trial, and this result can be used directly in the second trial, *i.e.* the method can be one of successive approximation if required. Convergence to the correct answer is very sharp and rapid, with practically all problems being solved in 3 trials.
J. R. T.

1820. Perforated trays designed this way. C. J. Huang and J. R. Hodson. *Petrol. Refin.*, 1958, **37** (2), 104–18.—A comprehensive method for the design of perforated trays, including the most reliable information from several sources, is presented under several main headings, namely, process requirements, design standards, and operation performance. All the equations required are given, and many are reduced to nomograms to make calculations easier and also to allow quick examination of a number of different tray situations. A detailed perforated tray design calculation is presented to illustrate the use of these equations and nomograms. Limits are suggested for some of the dimensions, and these are incorporated in a performance chart which allows prediction of the range of satisfactory operation. The performance chart can also be used to rate an existing installation. J. R. T.

ABSORPTION AND ADSORPTION

1821. How to design static adsorption beds. W. A. Johnston and C. D. Laughlin. *Petrol. Refin.*, 1958, **37** (2), 131–4.—Several useful equations for the design of static adsorption beds are given. The equations and data presented were developed on the attapulsite type of clay and activated bauxites, but should be applicable to other types of adsorbents. Methods of control of temp, pressure, and flow are outlined, and the main items which constitute the direct operating costs are considered. J. R. T.

1822. New agitator absorber for CO_2. A. S. Moore and S. Katell. *Petrol. Refin.*, 1958, **37** (3), 163–8.—A description is given of an agitator-type contactor used in the study of absorption of CO_2 in a 40% soln of diethanolamine in water. The results of a statistical investigation of the characteristics of this absorber with respect to process pressure, CO_2 content of feed gas, absorbent solution rate, and liq-to-gas ratio are presented. An empirical performance equation, using the factors tested, has been developed which allows direct calculation of the operating conditions. A comparison between the performance of this type of absorber and that of conventional scrubbers is also presented. J. R. T.

SOLVENT EXTRACTION AND DEWAXING

1823. Decomposition of a lignite-paraffin oil with selective solvents. (In German.) E. Gundermann. *Erdol u. Kohle*, 1957, **10**, 151–7, 228–31.—Pt 1. Investigation with methanol and methanol mixtures as solvents. Pt 2. Investigations with different solvents in the liq–solid phase.—A slack-wax type paraffin oil is extracted with selective solvents and solvent mixtures to obtain max yield of raffinate with minimum acid portions (creosotes), asphalts, and dark material. Stress is laid on CH_3OH and its combinations in the liq phase, enabling raffinate separation from extracts with disk centrifuges. 90% CH_3OH–paraffin oil—methanol ratio 1–2 at 50° C—gives optimum yields. Practically all the *n*-paraffins are recovered from charged material. With 100% CH_3OH—under the same conditions—the yield is 80·6% of the material charged; decreosoting is 91·8%. With 90% CH_3OH decreosoting was rather less. No important differences in asphalt separation occur. Selectivity of CH_3OH for the dark constituent is moderate, giving a dark brown raffinate. Benzyl alcohol gives the brightest raffinate. Benzyl alcohol 50 wt % and CH_3OH 50 wt % and ethylene chlorhydrin give light brown raffinates but a yield < with 100% CH_3OH. Glycol (1–2 at 50° C gives the highest raffinate yield). Pt 2. Raffinate yields with glacial acetic acid are somewhat lower than with 100% CH_3OH. With a ratio 1–2 and 50° C 77·4% of the *n*-paraffins of the paraffin oils are recovered. Glacial acetic acid acts on the dark substance slightly better than 100% CH_3OH. Acetone, *iso*propanol, butanone, *n*-amyl alcohol, and glacial acetic acid are unsuitable on account of their strong solvent power for hydrocarbons at high temp in the liq phase. In the " liq–solid " phase—separation temp 20° C—the yields are considerably smaller than with CH_3OH and the other previously named solvents. The smallest yields are with *n*-amyl alcohol and glacial acetic acid. The tested ketones, alcohols, and esters, excepting *iso*propanol, show relatively good selectivity for the dark substances. With none of the solvents is a yellow or white raffinate obtainable. Their selectivity for creosotes is no better than that of CH_3OH. R. T.

CRACKING

1824. Better yields after nitrogen removal. C. K. Viland. *Petrol. Refin.*, 1958, **37** (3), 197–200.—Gasoline production and quality can be expected to increase if unfavourable feedstock factors can be corrected or eliminated. This article summarizes some original data showing improvements in cat cracking yields obtained by removal of basic nitrogen from a heavy naphthenic California gas oil. The effect is substantiated by addition of high boiling basic and non-basic nitrogen cpds to a highly paraffinic petroleum dist from a crude of low nitrogen content which normally produces exceptionally high yields of gasoline. The unfavourable action of the basic nitrogen cpds is believed to be through neutralization of the active acid cat centres, since activity is restored by regeneration. J. R. T.

1825. Physical structure of silica alumina catalysts. J. H. Ramser and P. B. Hill. *Industr. Engng Chem.*, 1958, **50** (1), 117–24.—One of the important physical properties of a cracking cat is the accessibility of its surface to the reactants. This depends largely on the pore dia, which varies widely with silica–alumina cat. Previous investigators have used in their calculations an " average " pore radius based on pore vol and surface area, or by qualitative inspection of adsorption–desorption isotherms. In the present work pore size distributions were calculated from adsorption isotherms, and the " average " pore radius calculated from size distribution curves is *ca* ½ that estimated from the pore vol and surface area method. Description is given of the experimental procedure used and the results obtained. The distribution functions are calculated, and fundamental mathematical relations presented. D. K. R.

1826. Charts make cat cracker balance easier. O. A. Wunderlich and F. E. Ivey, Jr. *Petrol. Refin.*, 1958, **37** (2), 135–42.—A series of charts which indicate the important factors to be considered in regenerator heat balances is presented. They show that the cracking cat has a direct influence on the dependent variables of CO_2/CO ratio and the quantity of coke burned. The cat indirectly influences the independent variables of air rate, regenerator bed temp, and cat circulation rate through the coke burning rate of the cat. An actual example is considered to illustrate the use of these charts. The calculation can be used to detect erroneous data and to set up new operating conditions. J. R. T.

1827. Tips on refining problems. J. D. Walk *et al.* *Oil Gas J.*, 31.3.58, **56** (13) 85; 7.4.58, **56** (14), 157; 5.5.58, **56** (18), 115; 12.5.58, **56** (19), 129.—Pt 1. Problems in cat cracking and reforming, alkylation, and other refinery processes are discussed.

Pt 2. Continues with answers and questions in cat cracking and reforming, alkylation, and other refining problems.

Pt 3. Continues with questions and answers on problems in cat cracking, reforming, alkylation, and other problems, including questions on O.N., chloride corrosion, and cat corrosion.

Pt 4. Questions and answers on refinery problems deals with alkylation and tank fires. G. A. C.

ISOMERIZATION

1828. Alkar and Butamer—two new refining processes. H. W. Grote. *Oil Gas J.*, 31.3.58, **56** (13), 73.—The Butamer process is for economic conversion of normal butane to *iso*-butane; the Alkar utilizes by alkylation the light olefin content of refinery fuel gas. Tables show process economics and results. G. A. C.

CHEMICAL AND PHYSICAL REFINING

1829. Chemical purification of sump-phase middle oil from petroleum residue hydrogenation. P. Hofmann. *Erdöl u. Kohle*, 1957, **10**, 222–5.—Colour and storage instability and residue formation in the diesel motor combustion chamber are faults—in spite of apparent suitability indicated by chem analysis—which must be removed to render sump-phase middle oil suitable as a diesel power fuel. Colour instability is attributable to presence of phenols, and storage instability to presence of N-containing cpds. Phenols and bases cannot be removed completely, for the elementary analysis signifies that the bases contain S and O_2, and the phenols also S and N; so both possess amphoteric properties. In spite of the residual cont of bases and phenols still remaining, the raffinate with an FZ (Formol No.) from 0·00 to 0·1, and with a Phenolate No. from 0·2 to 0·6, is suitable still for tech purposes, the colour stability being satisfactory. No longer do resins precipitate on storage, the absorptive power for O_2 on warming is normal, and, above all, only the normal deposits occur in the motor. Formulæ for individual phenols and bases are given. R. T.

1830. An ultrasonic agitator whips it up. C. S. Cronan. *Chem. Engng*, 1958, **65** (5), 94–6.—An English ultrasonic agitator is described. It is claimed to excel in mixing such materials as 95% H_2SO_4 and gasoline, giving better mixing and therefore more complete reaction than normal methods, with only ⅓ normal capital outlay and $\frac{1}{10}$ usual power consumption. P. J. O.

1831. Effect of pulsations on behaviour of a batch thermal diffusion column for liquids. F. de Maria and R. F. Benenati. *Industr. Engng Chem.*, 1958, **50** (1), 63–6.—As pulsed pressure waves have been found to have a beneficial effect on the performance of extraction columns, work was done to discover whether a form of pulsation would improve the performance of a thermal diffusion column. The column and the method of pulsation are described. Pulsations could be varied up to 120 cycles/minute, with a max amplitude causing a displacement of *ca* 9·9 mm of the liq in the column. Description is given of the procedure used and the results obtained, which are given in tabular and graphical form. The results are discussed and a general conclusion reached that separation is decreased due to longitudinal mixing. D. K. R.

1832. Recovery of waste acid from benzole refining plants. Anon. *Chem. Proc. Engng*, 1958, **39**, 170–1.—H_2SO_4 which has been used for refining crude benzole contains resinous matter. This can be almost completely removed by extraction with phenols, cresols being preferred. Provisional patent spec describe cyclic process, cresols being recovered by dist. The purified H_2SO_4 can be used to make $(NH_4)_2SO_4$, or re-conc by evaporation. W. A. M.

SPECIAL PROCESSES

1833. Fluid coking development: a mechanically fluidized reactor. B. V. Molstedt and J. F. Moser, Jr. *Industr. Engng Chem.*, 1958, **50** (1), 21–3.—The fluid coking process for converting residual stocks into end products, consisting principally of coke, gas oil, and gasoline, takes place in 2 fluidized vessels, *i.e.* the reactor and the heating vessel. During the development of this process a principal problem was the duplication of the proposed commercial process conditions in pilot equipment. The reaction is primarily a liq phase one, and steam is normally added as diluent to fluidize the coke particles. For a small pilot reactor something like 10 times the proportion of diluent would be needed to give similar fluidization, thus destroying the basic similarity of reactor conditions. To meet this difficulty a stirred reactor was developed. Details of this stirred reactor and its design are given, and the results obtained from this mechanically agitated reactor agree well with data from a large-scale 100-b.d. pilot plant which was built later. D. K. R.

1834. Selective hydrogenation–desulphurization of gasoline produced by cracking. H. Heinemann, F. W. Kirsch, and T. A. Burtis. *Erdöl u. Kohle*, 1957, **10**, 225–8.—Gasoline produced by cracking, with relatively high S cont, can be desulphurized selectively by hydrogenation. The product suffers no loss in O.N., and the S level permits mixing with other refinery gasolines. The process is based on the hydrogenation of a high-b.p., S-rich, olefin-lean fraction over a Co–Mo–Al_2O_3-cat at 20 atm pressure. Hydrogenation of aromatic C_8- and C_9-hydrocarbons must be avoided. Cat life before regeneration corresponds to an estimated throughflow of $\leqslant$ 35,000–42,000 l gasoline/kg cat. R. T.

1835. Newest acetylene process from Japan. S. Tsutsumi. *Petrol. Refin.*, 1958, **37** (3), 169–71.—A new process for the production of acetylene from gaseous hydrocarbons in the methane to butane range is described. The process operates at 1200°–1250° C at reduced pressures and uses low oxygen to hydrocarbon ratios. The reaction can be carried out using a silica cat, but proceeds well without any cat. Hydrogen is used to prevent coking when using the higher hydrocarbons. Acetylene yields as high as 50% have been obtained using oxygen–methane ratios of *ca* 0·2–0·5. J. R. T.

1836. Terephthalic acid from xylenes. P. W. Sherwood. *Petrol. Refin.*, 1958, **37** (2), 155–62.—Several processes for the production of terephthalic acid from xylene are described. These consist of oxidn by nitric acid, oxidn by sulphur cpds, including elemental sulphur and ammonium sulphate, and air oxidn. Methods of purification of the *p*-xylene used as raw material in these processes are discussed. Evaluation of the 3 different methods shows that several factors must be considered in deciding on the best process. These include yield of terephthalic acid and investment and operating cost of aux processes, *e.g.* production of sulphur from the H_2S formed in the sulphur oxidn process, or production of N_2O_5 from the oxides of nitrogen formed in the nitric acid process. J. R. T.

METERING AND CONTROL

1837. Testing the oil industry's meters. M. L. Barrett, Jr. *Mech. Engng, N.Y.*, May 1958, **80** (5), 61–6.—This is condensed from ASME papers No. 57–Pet–17.

Meter-proving systems described are volumetric and gravimetric type provers, both of which can be used with the "running" or "stop and start" methods, and either closed or open. Fluid displacement provers, vapour-condensing provers, and the master meter are briefly described and the bi- and uni-directional piston displacement procedures of the Shell Oil Co. are given in some detail. 9 figs. E. M. I.

1838. Meter proving. Pt 5. Constructing meter provers. M. L. Barrett. *Oil Gas J.*, 5.5.58, **56** (18), 133.—Care must be exercised in the design and size of proving devices; max flow rate, physical properties of the test liq, and costs are other factors to be considered. G. A. C.

1839. Total count technique in the refinery. D. E. Hull. *Industr. Engng Chem.*, 1958, **50** (2), 199–200.—This new principle in measuring flow rates is based on measurement of the number of counts given out by a radio-active tracer as it passes a detector. The number of counts varies inversely with the flow rate and from simple theory, which is given, an absolute measurement may be made after a static calibration. An example of this type of flow measurement is given. Another method of using radioactive tracer for flow measurement is the Two Point method, when the time for pulsed injections to travel between 2 counters is measured to give the fluid velocity. The accuracy of the total count technique is discussed and estimated as an average 2–5% in standard plant. The technique can also be used for measuring leak rates of one liq stream into another, and for measuring entrainment in dist processes. D. K. R.

PRODUCTS

CHEMISTRY AND PHYSICS

1840. Equilibrium data now available for *cyclo*hexane. D. S. Hoffman and J. H. Weber. *Petrol. Refin.*, 1958, **37** (2), 143–5.—A practical method for the evaluation of vaporization equilibrium constants is described. Data for *cyclo*hexane over the temp range 40°–460° F and pressures up to 400 p.s.i.a.are presented both graphically and in tabular form. J. R. T.

1841. Find heat of fusion and sublimation. W. R. Gambill. *Chem. Engng*, 1958, **65** (5), 147–9.—Methods of calculating heats of fusion, sublimation, absorption, and adsorption are described. P. J. O.

1842. Poly*cyclo*paraffin hydrocarbons in petroleum. B. J. Mair *et al.* *Industr. Engng Chem.*, 1958, **50** (1), 115–16.—A summary of present knowledge of poly*cyclo*paraffin hydro-

carbons in petroleum is presented. A table of the 1520 possible bi*cyclo*paraffins is given, and it is pointed out that only 59 of these are likely to be present in petroleum. The data are presented considering the 3 fractions of petroleum—gasoline fraction, kerosine fraction, and gas oil and lubricant fraction, separately. D. K. R.

1843. Pressure dependence of the dielectric strength of hydrocarbons. (In German.) H. Luther and H. Röttger. *Elektrotech. Z.*, 1957, **78(A)**, 462–5.—The electrical insulating properties of hydrocarbon oils are dependent both on the structure of the hydrocarbon and on the pressure. The nature of this dependence has been investigated for oils saturated with a number of different gases. Over the pressure range investigated (10^{-2} to 760 mm Hg) the di-electric strength varies with pressure, but is independent of the type and quantity of the dissolved gas when using nitrogen, oxygen, or carbon dioxide. However, a mixture of butane and propane reduced the dielectric strength by 20% (at atm pressure) below the value obtained for the other gases. The breakdown strength depends on the density of the system, the ionization energy, and the vapour pressure of the components. P. J. K.

1844. Graph your way to C_p/C_v of hydrocarbons. J. Joffe and E. J. Delaney. *Chem. Engng*, 1958, **65** (6), 138–41.—Some new data on the heat capacity ratio for methane, ethane, ethylene, propane, and *n*-butane are presented. It is in the form of graphs of C_p/C_v *v.* temp, with pressure as a parameter. Derived from the Benedict–Webb–Rubin equation of state, the graphs cover the ranges 0°–1300° F and 0–10,000 p.s.i. P. J. O.

1845. Surface tension for pure liquids. W. R. Gambill. *Chem. Engng*, 1958, **65** (7), 146–50.—Methods of estimating the surface tension of pure liq are discussed, and a chart showing the variation in surface tension of paraffin hydrocarbons with temp is given. Knowledge of surface tension is useful in calculations on dist, oil recovery process, heat transfer to boiling liq, etc. P. J. O.

1846. Pyrolysis of aromatics and related heterocyclics. J. J. Madison and R. M. Roberts. *Industr. Engng Chem.*, 1958, **50** (2), 237–50.—In the thermal cracking of heavy fractions of petroleum there is a tendency for some condensation to take place, producing products of higher mol. wt. than the feed. Experiments done on 43 aromatics and related heterocyclics to study this condensation are reported. The substances were subjected to pyrolysis in the absence of air, and as experiments with anthracene showed that condensation was rapid only in liq phase pyrolysis, and as thermal cracking of heavy petroleum stocks is always done in liq phase reactions, nearly all the tests were carried out in this phase. Details of the experimental procedures used in both the liq and gas phase pyrolysis are given; also the methods of purification and properties of the cpds studied. The cpds are considered in 9 groups, the results being presented in some detail and tables of the analysis of products after pyrolysis given. D. K. R.

1847. Breakdown of transformer oil. R. Hancox and H. Tropper. *Elect. Times*, 1958, **133**, 93–4.—Summary of paper given to IEE. Impulse tests in 9-inch dia, 18-inch high chamber, 6·25 cm dia meticulously cleaned brass spheres, 2·5 mm gap, 2/60 microsec waveform, atm pressure, 20° C, oil to BS 148/1951 (28 cS/21° C) carefully filtered and degassed. Conditioning effect (increase of electric strength with successive breakdowns) is observed with degassed but not with undegassed oil. Strength increased with decreasing electrode size (750 kV/cm at 6·25 cm, 990 kV/cm at 2·5 cm, reported value of 1450 kV/cm quoted for 13 mm at $\frac{1}{25}$-microsec pulses). Impulse breakdown due to electron emission from electrode is influenced by presence of gas layer thereon; microscopic bubbles at the liq/solid interface enhanced electron emission, establishment of craters on electrode after multiple breakdowns facilitated bubble formation, leading to erratic results following conditioning period. V. B.

1848. Flame ionization detector for gas chromatography. I. G. McWilliam and R. A. Dewar. *Nature, Lond.*, 1958, **181**, 760.—The electrical conductivity of a H_2/N_2 flame burning in air is found to be sensitive in high degree to the vapours of organic cpds. The apparatus comprises a double triode impedance conversion circuit (voltage gain *ca* × 2) with a reference jet feeding one grid and the detection jet feeding the other. The electrodes are the metal jet itself and a piece of 30-mesh brass gauze held horizontally 1 cm above. For ether the sensitivity is estimated at 4×10^{-10} g, and is thought to be limited by the electronic equipment rather than the flame stability. Hydrocarbons and chlorinated hydrocarbons give good responses. H. C. E.

ANALYSIS AND TESTING

1849. Titrimetric determination of dissolved sulphur in mineral oils and fats. F. Stinsky. *Erdöl u. Kohle*, 1957, **10**, 231.—A titrimetric method is described as a substitute for conventional methods for estimating free or "active" S in mineral oils, fats, and factice. The time required is <1 hr—conventional methods ≮24 hr—with equal accuracy as shown by check analyses. R. T.

1850. Rapid determination of carbon and hydrogen in highly volatile combustible organic liquids. A. R. Panicker and N. G. Banerjee. *Analyst*, 1958, **83**, 296–9.—A sample tube (Pyrex) 1 mm i.d. is described and illustrated. A 0·1–0·2-g sample is taken, the sample tube is inserted into a quartz combustion tube, the packing of which is described, and the sample is evaporated at a controlled rate by passing N_2, and burned in O_2. Illustrated description of purification and absorption trains is given. Test takes 45 minutes, and replicate results lie generally within ±0·14% for C and ±0·07% for H. Method is applicable to org liq of low b.p., including petroleum dist, to soln in low b.p. solvents, and to mixtures of org liq or solids of low and high b.p. W. A. M.

1851. Apparatus for determination of traces of sulphur or halogens in volatile organic liquids by rapid combustion. F. Martin and A. Floret. *Chim. anal.*, 1958, **40**, 120–6.—Org liq is vaporized, entrained with CO_2, and burned in glass blowpipe with O_2 at rate of 1 ml/minute. Gases produced are passed through an absorber, and resulting H_2SO_4 or halogen acids titrated or determined nephelometrically. Detailed dimensioned diagrams of apparatus are given and method described. Low S (*ca* 1 p.p.m.) is determined by colorimetric (methylene blue) measurement of H_2S from reduction of the H_2SO_4 formed. Method is applicable to toluene, cumene, acetic acid and anhydride, *cyclo*hexanol, propylene glycol, and white spirit. W. A. M.

1852. Supersonant velocity determination in saturated mineral oil fractions and their surface tension from kinematic viscosity and refractive index. (In German.) J. Cornelissen, O. Harva, and H. S. Waterman. *Erdöl u. Kohle*, 1957, **10**, 80–2.—The density at 20° C (d_4^{20}) and the mol. wt. of saturated mineral oil fractions can be related to the log of the kin. visc. in cS at 20° C (log ν_{20}). The authors have confirmed that—in a system with the known magnitudes log ν_{20} and n_D^{20} as co-ordinates—a diagram can be constructed from which the supersonant velocity at 20° C (u_{20}) in fractions of saturated mineral oils, and their surface tension σ can be taken. The oils from which these fractions were taken were of different origin. Saturation resulted from careful hydrogenation. 10 refs. R. T.

1853. A V.T.-nomogram for dynamic and kinematic viscosity of mineral oil in the temperature range 20° C to 150° C. (In German.) W. Schwebke. *Erdöl u. Kohle*, 1957, **10**, 75–9.—Graphic and mathematical aids are reviewed which are available—according to the accuracy required—for determining the visc of mineral oils. The following applies to the temp range 20°–150° C. For calculations permitting a mean error >2%, the visc of the mineral oils of which 2 visc val, but not d, are known, can be determined graphically with the new V.T.-nomogram or the Niemann diagram, and can be converted to the other visc by the Mahncke formula. In case only the kin. visc. at 2 temp is known, a V.T.-nomogram can be used along with whose visc scale for ν in cS a visc scale for η in cP, calc by the Mahncke formula is drawn. For calculations with an average error *ca* 1·3–2% knowledge of 2 visc-temp pairs of val and of d of the mineral oil is necessary. Under these assumptions the Vogel–Cameron equation, the Niemann diagram, or the new V.T.-nomogram can be used to determine η and ν. If these val are required for a large No. of oils the V.T. nomogram offers advantages. R. T.

1854. Micro-density determination of liquid hydrocarbons by the ascending drop method. (In German.) G. Nettesheim. *Erdöl u. Kohle*, 1957, **10**, 73–4.—The simple, rapid method described employs empirically ascertained relationships between d and ascent time. d is determined—with accuracy 0·5%—from the time of ascent or descent of oil drops in a suitable liq, in this case H_2O. No calibration of the apparatus is necessary, since the same time law is valid for the same d difference of the samples against H_2O. Only *ca* 3 mg of substance is required, so that small quantities of liq as obtained in chromatographic separations or analytical dist suffice.
R. T.

1855. Temperature determination in flames by X-ray absorption using a radioactive source. G. T. Mullaney. *Rev. Sci. Instrum.*, 1958, **29**, 87–91.—Flame temp can be estimated from the change in X-ray intensity, as measured by a Geiger counter, after passage of emanation from Fe^{55} (half-life 2·94 years) horizontally through a flame. In the experiments described, propane was burned with O_2 in a water-cooled porous metal burner, with argon added to give a high absorption coeff.

Comparisons of the temp recorded with other forms of measurement showed an approx straight line relationship. The main sources of error are the variation of mean mol. wt. of the gas mixture, uncertainty in the length of the hot gas path, uncertainty in the mass absorption coeff for argon, and counting error. H. C. E.

1856. Monitoring and control with automatic analysers. N. M. Fourroux. *Oil Gas J.*, 21.4.58, **56** (16), 114.—A standard 5-minute cycle chromatographic analyser has been successfully used to control a debutanizer column, by measuring *iso*pentane on the 9th tray controlled steam flow to reboiler through a temp recorder controller on 14th tray. The control system, test run, and results are described. G. A. C.

1857. Brittle fracture in steel as related to flash-welded line pipe. Pt 2. M. A. Scheil *et al.* *Engng J., Montreal*, 1958, **41**, 59–63.—This article—containing a bibliography of important lit refs—presents concepts of brittle fracture for 0·20–0·30% C medium Mn steel. Concepts currently held for brittle fracture are presented graphically for a mild steel with stress and temp necessary to propagate fracture. At any temp below fracture transition a crack—forced to initiate at one side of a plate 6-inches wide, firmly gripped in a testing machine under a temp and stress series—will proceed across the plate without measurable deformation at 5000 p.s.i. stress. Above the fracture transmission temp the crack will not propagate until the load is > the steel yield strength. Nil-ductility transition temp is obtained from Charpy, drop-weight, or explosion bulge tests. A diagram shows schematically how relative temp dependence of resistance to flow and to fracture predicts temp effect in inducing brittleness in tension, compression, and torsion. Brittleness or ductility depends on whether the metal first reaches max normal stress required for fracture or max shear stress required for flow. At sufficiently high temp max shear stress required for flow is so low that, under almost any condition of loading, it will be reached before the max normal stress reaches its crit val, so in almost any test a metal will be ductile at high temp. As temp is lowered shear stress required for flow increases, while normal stress for fracture changes very little, so that, as the temp is lowered, danger of brittle failure increases. As the temp is lowered, metals become brittle in the notch bend test before losing ductility in tension or twisting. R. T.

1858. Evaluating cutting fluids in accelerated machining tests. F. J. Daasch *et al.* *Lubric. Engng*, 1957, **13** (9), 516–20.—Limitations of previous methods of evaluating cutting fluids are indicated and details are presented of new methods of evaluation using radiometric tool wear and tool force methods as providing accelerated tests under actual machining conditions. 3 emulsifiable oils and 3 mineral compounded oils were tested, and the programme was so arranged as to lend itself to statistical treatment. Results so obtained indicated that compounded mineral oils resulted in much less tool wear, but revealed little variation between oils of same type. Suggestions are presented for extended investigations for distinguishing between fluids of the same type. J. G. H.

1859. Cam and tappet test for lubricants. 1. Anti-scuff evaluation. E. H. Loeser *et al.* *Lubric. Engng*, 1957, **13** (4), 191–6.—The weaknesses of studies of cam and tappet failure based on dynamometer and road tests is remarked, and the advantages of bench testing with design, metallurgical, and operating conditions under close control are emphasized. Earlier bench test procedures are noted, and details are presented of construction and operating procedure of a new bench-type tester in which lubricant is main variable. Cam and tappet assembly immersed in oil was subjected to loaded motoring until failure occurred, anti-scuff rating being based on period and load. Value of zinc dialkyl dithiophosphate as anti-scuff additive was demonstrated, its effectiveness being due to its anti-welding and wear acceleration properties, the latter functioning through the provision of larger contact areas, resulting in lower stresses. J. G. H.

1860. Analyse for Ba, Ca, and Zn this way. R. J. Bertolacini. *Petrol. Refin.*, 1958, **37** (2), 147–9.—A description is given of an extraction–titration method for the determination of barium, calcium, and zinc, singly or in combination in lub oil additives and blended oils. The extraction is achieved with hydrochloric acid and the titration is complexometrically with Na_4 EDTA. The method is sufficiently rapid to be applied to quality control in manufacturing and also accurate enough to use as a referee. Use of this method allows analysis of 8 samples/day by one person, compared with the 2 or 3 days taken by conventional methods. The technique is applicable to used oils if their history is known and if interfering metals can be masked or separated. J. R. T.

1861. Dynamic demulsibility characteristics of oils. E. W. Brennan and R. G. Mayer. *Lubric. Engng*, 1957, **13** (3), 146–50.—Present method for determination of demulsibility characteristics of circulating oils affords little or no correlation with actual field performance. Details are presented of a dynamic demulsibility apparatus developed by Pure Oil Co. and test results obtained on base oils, turbine oils, and paper machine oils are tabulated and discussed in some detail; additional applications are indicated. J. G. H.

1862. Gas chromatography. (In German.) O. Horn, U. Schwenk, and H. Hachenberg. *BrennstChemie*, 1957, **38**, 116–20.—Advantages of the thermal conductivity cell in gas chromatography are explained. With the apparatus described and illustrated—using H_2 as support—practically all liq up to b.p. 350° C can be chromatographed. When using N diffusion is < with H_2 and the separation sharper; however, the difference in thermal conductivities is < in H_2—an amplifier is required. In contrast to the absolute or integral method—a differential method—great care must be taken in the thermal-conductivity method—on reproducibility grounds—to keep temp and flow rate const. Column fillers are discussed with special ref to separation of 2 components with the same b.p. Preparative applications are discussed. Graphic illustrations include a chromatogram on silica gel, partition equilibrium between gas and fixed phase, simultaneous wandering and separation of 2 components with different partition coeff, and concn course in the column at different times during the chromatographing. 23 refs. R. T.

1863. Chromatography is a plant workhouse. J. F. Hickerson. *Oil Gas J.*, 21.4.58, **56** (16), 119.—Humble Oil and Refining Co. uses 4 chromatographs on its Baytown refinery lab to analyse *ca* 2000 samples each month, and finds benzyl cellosolve is best as light substrate. G. A. C.

1864. Chromatography guides fractionator operation. A. B. Altom. *Oil Gas J.*, 21.4.58, **56** (16), 122.—Use of chromatograph has eliminated control tests such as vapour pressure dist and weathering in operating depropanizer receiving deethanizer charge. G. A. C.

1865. Chromatograph has quick payout at Snyder plant. B. Denny. *Oil Gas J.*, 21.4.68, **56** (16), 117.—Use of a process model chromatograph stream analyser resulted in propane-recovery increase with gain of $10,500/month. G. A. C.

1866. Gas chromatography in the laboratory. L. N. Locke. *Oil Gas J.*, 21.4.58, **56** (16), 120.—Use is described by Continental Oil Co. of chromatography in their Ponca City refinery for analysis of light components in refinery streams. Control samples are analysed daily on reformer naphtha reformate and 6 control points in the aromatic extraction unit; determinations at 200° F take *ca* 30 minutes. G. A. C.

1867. Chromatography of gases and vapours. (In German.) G. Voss and F. Hessenauer. *Erdöl u. Kohle*, 1957, **10**, 161–3.—3 procedures are presented with supporting diagrams: frontal, displacement, and elution chromatography. The first is limited to mixtures of a few components. In the second an innovation is the use of an adjustable furnace in place of the displacing agent. Uses, advantages, and disadvantages of the processes are discussed. Functions of column packing materials, supporters, detectors and recorders, sample introduction, and operating tehniques are considered. Gas chromatography is comparable with mass and i.r. spectrometry, and is superior to low-temp dist in many aspects. Accurate analyses can be obtained by introducing connecting columns for hydrogenation or separation of olefins. Future prospects are discussed. 18 refs. R. T.

1868. Gas–liquid partition chromatography. P. E. Moghadame. *Chim. anal.*, 1958, **40**, 149–55.—Discussion of theory, brief description of IFP apparatus (*cf* Abs. **1824**, 1957), review of factors affecting column efficiency, examples of analyses of 2 mixtures: 6-component C_5–C_6 saturated hydrocarbons (column impregnated with eicosane), and 5-component C_1–C_4 alc (column impregnated with di-(3–5–5-trimethylhexyl) phthalate). V. B.

1869. Rheology of bitumens. Relations between dynamic viscosity and conventional testing procedures for bitumens and similar thermoplastics. F. Schlosser and F. Hempel. *Erdöl u. Kohle*, 1957, **10**, 232–8.—Const shear stress is taken as the basis of temp-dependent visc measurements at numerous temp on bitumens and thermoplastics. Temp grades for soft. pt. and drop. pt. according to DIN 1995—in a diagram for visc–temp straight lines—are used to form characteristic lines. Each pt on these lines is a possible soft. pt. after K.–S. or after the R. & B. method, or a drop. pt. after Ubbelohde, and corresponds to a definable dynamic visc. The connexion between temp-dependent course of the dynamic visc and test val determined by conventional methods permits inversely, from the found temp grades, the soft. pt. after K.–S. and after the R. & B. method, predicting the rheological character of a bitumen. R. T.

GAS

1870. Proving the efficiency of high pressure gasification and hydrogenation. Anon. *Gas Times*, 1958, **92** (917), 55.—The gasification system of a £2-million plant is a sequence of continuous automatically-controlled processes, commencing with production of H_2 >90% purity by oil gasification (later low-grade coal), at 400 p.s.i. with O_2 and steam. The H_2 produced is used to hydrogenate further oil or coal to produce gas of *ca* 600 B.t.u/ft³ cal. val. R. T.

1871. Manufactured gas. F. Arne. *Chem. Engng*, 1958, **65** (6), 121–32.—A survey of processes for the production of gas from coal and oil is presented. Large demand in winter means that gas makers have to supplement the natural gas they buy from pipeline companies with gas from other sources, so that current interest is strongest in low capital cost plant for peak load shaving, and in the light dist fuels needed by this type of plant. The processes described include the Hall process, Koppers-Hasche, cat cracking and reforming processes, hydrogasification processes for heavy and light oils; also coal gasification, the Lurgi and Flesch-Demag processes, together with new American processes for gasification, either with oxygen and steam or by direct hydrogenation. P. J. O.

1872. Liquefied natural gas. C. I. Kelly. *Petrol. Times*, 11.4.58, **62** (1583), 318; 25.4.58, **62** (1584), 349; 9.5.58, **62** (1585), 383.—Pt V concerns performance of barge tanks designed and built, and one appendix gives tentative requirements for transportation of liquefied inflammable gases in bulk in the U.S.A.; the other appendix distinguishes between liquefied natural gas and petroleum gases.

In Pt VI the transport of liquefied natural gas in converted tankers is studied, and transportation costs from Venezuela to Philadelphia tabulated and discussed. Salient features of the conversion are outlined.

In Pt VII the salient characteristics of Crecca's proposed converted liq methane carrier are dealt with, including construction metal, welded joints, methane storage tank insulation, piping system, and costs of transportation to Southampton. G. A. C.

ENGINE FUELS

1873. Shock tube technique for study of auto-ignition of liquid fuel sprays. G. T. Mullaney. *Industr. Engng Chem.*, 1958, **50** (1), 53–8.—The shock tube is a useful apparatus for obtaining empirical data about the auto-ignition of liq fuel sprays for the formation of theoretical models of the processes involved. The range of temp and pressures over which it can be used is very wide, and adjustment can be quickly made. A window section in the shock tube permits the use of high-speed photography for auto-ignition studies. Information is given on the design of the shock tube, and its performance is presented under the following headings: pressure *v.* time at the end of the shock tube; incidental shock wave attenuation

measurements; temp determination in the air behind the reflected shock wave by velocity of sound technique; method of fuel injection. An example of a typical auto-ignition experiment is given. D. K. R.

1874. Manganese—gasoline anti-knock. R. J. Riggs, W. W. Sabin, and C. J. Wolf. *Oil Gas J.*, 12.5.58, **56** (19), 107.—Methyl *cyclo*pentadienyl manganese tricarbonyl, a discovery by Ethyl Corpn, shows promise as an agent for octane improvement and is of considerable effect in paraffinic gasolines, such as natural gasoline, alkylate, and isomerization products. G. A. C.

1875. Surface ignition control by phosphorous fuel additives. J. B. Hinkamp and J. A. Warren. *Industr. Engng Chem.*, 1958, **50** (2), 251–6.—Normal ignition in an Otto-cycle engine may be interfered with if deposits in the combustion chamber become sufficiently heated to act as sources of ignition. This is called surface ignition, and its occurrence is closely related to the composition of the deposits. A series of experiments was carried out to discover how effective phosphorus additives are in reducing the occurrence and severity of surface ignition. A description of the equipment and instrumentation used is given, and the experiments are discussed under the following headings: variation in surface-ignition control by phosphorus cpds; influence of phosphorus on incidence of surface ignition; effect of phosphorus additives on phosphorus-free deposits; phosphorus additives and octane requirement increase; surface-ignition control at different TEL concn; surface-ignition control at different C.R. In the discussion of results, mechanisms by which phosphorus additives achieve their effectiveness are suggested. D. K. R.

1876. Diesel engine performance. A technique for reducing smoke and improving output. M. Alperstein, W. B. Swim, and P. H. Schweitzer. *Auto. Engr*, 1958, **48** (1), 22.—The technique described consists of introducing part of the fuel as a fine mist or fume into the intake manifold while the remainder is introduced in the conventional manner through the high pressure injection system into the cyl nearer t.d.c. position of the piston.

The micro-fog apparatus was employed to produce the mist, consisting of droplets under 4 μ. Test results are described with the aid of numerous graphs and tables. D. K.

1877. Cold-weather vapour-lock control. O. C. Bridgeman and E. W. Aldrich. *Oil Gas J.*, 28.4.58, **56** (17), 85.—A chart is given which permits evaluation of fuel characteristics for optimum ease of engine starting, compatible with any selected degree of vapour lock control. G. A. C.

1878. Combustion rates in spherical reactors. M. A. Weiss, R. J. Lang, and J. P. Longwell. *Industr. Engng Chem.*, 1958, **50** (2), 257–64.—Experiments have previously been done on combustion rates in insulated spherical reactors, altering the reaction temp by varying the fuel concn. On the assumption of complete mixing, the combustion rate is dependent only on the kinetics of the reaction and, assuming a very simple reaction, an energy of reaction of *ca* 42 kcal was found. In the experiments reported here this work has been extended to discover the effects of varying the fuel inlet temp and the type of fuel used. Description is given of the apparatus used. At high temp (*ca* 1100° F) 39 runs were performed obtaining lean blow-outs of *iso*-octane–air mixtures. The results of these runs are given in graphical and tabular form, and an overall apparent activation energy of from 42 to 45 kcal was confirmed. Lean blow-outs were performed with 11 different fuels; heptane, methane, di*cyclo*pentadiene, *iso*-octane + 5 vol % *n*-propyl nitrate, benzene, toluene, xylene, tetralin, *iso*propyl chloride, propylene oxide, and hydrogen. Only benzene and hydrogen were used for rich blow-outs. The results are given in tabular and graphical form, and it was found that with fuels other than *iso*-octane, differences in reactivity agree quantitatively with the differences in flame temp. The effect of fuel structure on the burning rate appeared to be less important for the hydrocarbons used than the non-hydrocarbons. D. K. R.

GAS OIL AND FUEL OIL

1879. Oil firing control. Anon. *Mech. World*, 1958, **138** (3465), 167–9.—This describes, with circuit diagram, a system, installed at Littlebrook-C Power Station, which controls the start-up, running, and shut-down of the oil-fired boilers from a control panel. The firing sequences controlled by the selector switches, the valves, and cyl used in the system are described. E. M. I.

1880. Three years' experience shows low pressure coking successful. C. E. Gibson. *Petrol. Engr*, 1958, **30** (3), C46–50.—Low operating pressures during the coking of crude bottoms favour the production of large quantities of gas oil for cat cracking with small amounts of coke and gasoline. Process operation and plant, including an unusual vertical tube heater for the coking furnace, with the use of a special steam injection arrangement, are described. A. E. R.

LUBRICANTS

1881. Cutting fluids: fundamentals and laboratory evaluation. L. H. Sudholz. *Lubric. Engng*, 1957, **13** (9), 509–15.—Fundamentals of the metal cutting process are briefly summarized, lubrication requirements are set out, and the components of cutting fluids are tabulated with their specific functions. Threading, drilling, and tapping tests are described, together with a radioactive tool wear method of evaluation. J. G. H.

1882. Role of sulphate—reducing bacteria in the deterioration of cutting emulsions. E. O. Bennett. *Lubric. Engng*, 1957, **13** (4), 215–18.—Bacterial growth in cutting emulsions has been known to accelerate deterioration for a considerable period, this being attributed to depletion of oxygen content of the emulsion. Details are presented of an investigation of the action of sulphate-reducing bacteria on used emulsions simulating weekend, *i.e.* with cutting fluid not agitated, conditions. These were found to be capable of spoiling emulsions, although additional factors are needed for continued spoilage. The method of entry of sulphate-reducing bacteria into cutting emulsions is discussed, and some methods of control of bacterial deterioration are indicated. 17 refs. J. G. H.

1883. Thermal conductivity of aircraft engine lubricants at low temperatures. V. E. Schrock and E. S. Starkman. *Lubric. Engng*, 1957, **13** (7), 393–8.—The desirability of adequate data on thermal properties of lubricants at low temp as a factor in aircraft engine design operation is emphasized, and details are presented of the procedure employed for determining thermal conductivities and thermal diffusivities of representive gas turbine and piston engine lubricants (to spec MIL–O–6081A and MIL–O–6082) over a temp range of −100° to +80° F, measurements being made in a spherical apparatus employing a thin film of material under test. While turbine oil showed linear variation of conductivity with temp, piston oil experienced a notable change on freezing, with positive temp coeff in solid phase, and negative one in liq phase. Existing empirical equations proved inadequate for this temp range. 28 refs. J. G. H.

1884. Application problems with petroleum lubricants in nuclear power plants. R. F. Hausman and E. R. Booser. *Lubric. Engng*, 1957, **13** (4), 199–202.—Lubrication of atomic power plants will present special problems in the reduced

accessibility of lubricating equipment, in the reduction of lubricant life in close proximity to the reactor, and in the possibility of radiation damage to components of lubrication system. Lubricants themselves are subject to oxidn and polymerization on exposure to radiation. Visc increase of 25% is considered to be safe limit. Lubricants with high aromatic content and some synthetic lubricants have proved more radiation-resistant. A lubricating system for a typical nuclear power plant is described and radiation levels in the various components tabulated. Precautions necessary in the disposal of waste lubricants are discussed, and recommendations are presented for minimizing radiation problems. 8 refs. J. G. H.

1885. Synthetic ester lubricants. R. S. Barnes and M. Z. Fainman. *Lubric. Engng*, 1957, **13** (8), 454–8.—Severe conditions encountered in lubricating current military and automotive equipment have resulted in the development of synthetic lubricants, of which those based on esters have proved most successful. Details are presented of the preparation and properties of a series of esters synthesized from polyhydric alcohols and monobasic acids. Products so prepared proved to have lubricity and thermal properties superior to those prepared from dibasic acids. Possibilities of production of necessary raw materials from petroleum sources should result in ample availability at low prices; further development work is still necessary. J. G. H.

1886. Specific heats of aircraft engine lubricants at low temperatures. V. E. Schrock and R. E. Gott. *Lubric. Engng*, 1957, **13** (6), 353–8.—The importance of accurate knowledge of thermal properties of lubricants in the design and performance evaluation of modern aircraft lubricating systems is stressed, and details are given of apparatus and methods used to measure specific heat of lub oils over the temp range of 70° to −100° F. Data so obtained on typical gas turbine and piston engine lubricants are presented and are found to be in close agreement with those obtained elsewhere. Under low temp conditions existing empirical relations for prediction of specific heats of petroleum oils were found to be inadequate. 24 refs. J. G. H.

1887. Choose your press drawing lubricants with care. L. Salz. *Lubric. Engng*, 1957, **13** (9), 494–500.—The function of lubrication in the metal drawing process is briefly reviewed, and the effects on lubrication requirements of type and condition of metal, severity of draw, and die efficiency are touched on. Requirements for press drawing lubricants are discussed from standpoints of performance, safety, stability, ease of application and removal, compatibility with welding operations, non-corrosiveness, and economy. Materials used in formulation of press drawing cpds are set out and their functions indicated, together with the constituents and characteristics of E.P. agents, emulsifiers, diluents, and inhibitors. The main types of finished products are set out, and a note is presented on special chemical or metallic coatings sometimes applied to ferrous metals as an aid to lubrication. J. G. H.

1888. Engine lubrication tests on a compound based on molybdenum disulphide. Anon. *Auto. Engr*, 1958, **48** (1), 19.—Some recent tests are described; these were made with "Auto-Moly," a molybdenum disulphide engine cpd developed by Charman Products Ltd for use in I.C. engines. The tests were carried out to determine if surfaces formed after "Automoly" had been added to the oil were strong enough to permit the engine to run: (1) in conditions of oil starvation, and (2) without oil at all. The test vehicle was an Austin A.50 Countryman van, and it was run for 872 miles during the test. D. K.

1889. Radiolysis and radiolytic oxidation of lubricants. R. O. Bolt and J. G. Carrol. *Industr. Engng Chem.*, 1958, **50** (2), 221–9.—As lubricants used in nuclear power stations must be radiation resistant, work has been done on the chemical effects of radiation on organic materials, and the effect of benzene in protecting less stable materials has been investigated. A survey is given of experiments conducted to find suitable materials for developing the required lubricants. As oxidn is speeded up by radiation, various oils, with and without additives, were tested for oxidn resistance. The most promising were then retested after irradiation. Details of test procedures and equipment used are given, and extensive results presented and discussed. D. K. R.

1890. Relation of relaxation theory to some properties of lubricants. H. Eyring *et al. NLGI Spokesm.*, 1956, **20** (3), 10–15.—A general reduced equation for transient and steady state behaviour of the visc of lubricants involving a single relaxation time is developed, and its application to pressure–visc relations and to visc–composition studies is indicated. 24 refs. J. G. H.

1891. Development of a lubricant for aircraft-ordnance, rubber-compatible and ice-resistant. H. R. Baker *et al. NLGI Spokesm.*, 1956, **20** (6), 20–4.—Details are presented of the development of GLT–700–60, and a low torque, semi-fluid grease with the following properties: effective lubrication over the range 65° to 160° F, compatibility with standard oil-resistant rubber, effective rust inhibition, and resistance to ice-immobilization. Required qualities were obtained by a blend of silicone and ester components with suitable rust inhibitors and anti-wear additives and a lithium soap thickener. Test methods used in assessing required properties are set out and functions of essential components in optimum proportions discussed. J. G. H.

1892. Transition temperature for surface damage in sliding metallic contact. L. F. Coffin. *Lubric. Engng*, 1957, **13** (7), 399–405.—Previous investigations of the interaction between mating metals in sliding contact have revealed that non-alloying metallic couples were subject to sliding by shear with low friction and relatively smooth wear, while alloying couples experienced sliding by welding with high friction and abraded contact surfaces. Present paper covers effect of liq atm and temp on alloying couples of copper and nickle, *i.e.* copper–copper, copper–nickel, and nickel–nickel. A transition temp for the various submersing liq was observed, below which sliding by shear occurred and above which sliding by welding took place. Transition temp was found to depend on boundary lub qualities of liq, choice of couple, and sliding velocity, and to be independent of applied load. J. G. H.

1893. Fibres, forces, and flow. E. O. Foster, J. J. Kolfenbach, and H. L. Leland. *NLGI Spokesm.*, 1956, **20** (3), 16–22.—The importance of a knowledge of grease structure in predicting performance is emphasized, and the use of electron microscopes and X-ray diffraction methods to this end is discussed. Points covered include forces in soap crystals, fibre formation, and the effect of shear on grease structure. J. G. H.

1894. Need for a viscosity classification of industrial lubricants. G. D. Jordan. *Sci. Lubric.*, 1957, **9** (10), 22–5.—The objectives and basic requirements of a generally acceptable industrial visc classification are set out, and units, reference temp, and preferred numbers are briefly discussed. Visc classifications suggested by ASTM (A and B), Gottner and Jones, are outlined and plotted on a log scale with BS 2626 and 489 for comparison. J. G. H.

1895. Viscosity temperature function. W. A. Wright. *Bull. Amer. Soc. Test. Mat.*, 1956, (215), 84–6.—Undesirable features of present V.I. classification are remarked and essential requirements of a suitable supplanting expression set out. On

this basis a new expression V.T.F. is developed and its advantages and applications outlined. 7 refs. J. G. H.

1896. Use of ASTM slope for predicting viscosities. E. E. Klaus and M. R. Fenske. *Bull. Amer. Soc. Test. Mat.*, 1956, (215), 87–94.—The development and applications of the ASTM slope as an expression of visc–temp characteristics is outlined, and advantages over the V.I. system for high visc oils are set out. Applications in polymer blending in extreme temp are discussed, together with relation with ASTM pour point. J. G. H.

1897. Place for emulsions as fire-resistant power transmission fluids. G. T. Coker, Jr. and C. E. Francis. *Lubric. Engng*, 1956, **12** (5), 323–6.—Extended applications of hydraulically-powered industrial equipment have resulted in accentuated demands for fire-resistant hydraulic fluids. Details are presented of the development, characteristics, and performance of a water-in-oil emulsion type fluid with data on lab and field tests. J. G. H.

1898. Some effects of gamma radiation on commercial lubricants. J. G. Carroll and S. R. Calish, Jr. *Lubric. Engng*, 1957, **13** (7), 388–92.—Details are presented of an investigation of the effects of gamma radiation on current conventional lubricants, including base and industrial oils, gear lubricants, industrial and multi-purpose greases. In general, effect was similar to severe oxidn, visc increased and V.I. improved. Compounded oils suffered some breakdown in composition, resulting in complications; wear properties and load-carrying capacity of some oils were noticeably improved, while greases showed a marked change in consistency. Several oils and greases proved capable of adequate service in the presence of gamma radiation of at leat 10^8 r. J. G. H.

1899. Solid lubricants for temperatures to 1000° F. M. B. Peterson and R. L. Johnson. *Lubric. Engng*, 1957, **13** (4), 203–7.—Increased operating temp of gas turbines and other aircraft engines have focused attention on possibilities of solids as high temp lubricants, as indicated by existing use of graphite and molybdenum disulphide in this direction. Desirable properties are postulated, and data are presented from an investigation of the suitability of a number of heavy metal oxides for the purpose, using a low speed kinetic friction apparatus. Of the cpds examined lead oxide (PbO) proved particularly promising, and was examined in some detail. It was found that in the temp range 700°–900° F some of the PbO was converted to Pb_3O_4, with a consequent increase in friction coeff. Above 1000° F the Pb_3O_4 reverts to PbO. J. G. H.

1900. Dynamic tests spark nuclear programme. Anon. *Lubric. Engng*, 1957, **13** (7), 380–3.—Equipment, including a new cobalt 60 " hot cell," installed at Inland Testing Lab, Morton Grove, Illinois, for the investigation of lubrication under " hot " conditions is described and illustrated. J. G. H.

1901. Predicting performance of starved bearings. D. F. Willock. *Lubric. Engng*, 1957, **13** (6), 348–52.—A mathematical treatment is presented for determining the performance of bearings which by reason of inadequate or obstructed oil channels are prone to suffer at high speeds or loads from inefficient lubrication. An extension of the procedure is included which permits estimation of time of operation before failure of bearings whose oil supply has been cut off. J. G. H.

1902. Effect of oxygen concentration in atmosphere on oil lubrication of high-temperature ball bearings. Z. N. Nemeth and W. J. Anderson. *Lubric. Engng*, 1956, **12** (5), 327–30.—Details are presented of an investigation of the operation of ball bearings at temp up to 850° F lubricated with 1010 turbine oil with an ambient atm consisting of air–nitrogen mixtures of various ratios. The bearing rig built round a floor-type drill press is described and illustrated. Solid molybdenum disulphide was tried as lubricant, but deteriorated to abrasive oxidn products. The useful life of liq lubricants was found to be lengthened by the exclusion of oxygen from the atm surrounding the bearing; effective oil lubrication was found to require an amount of oil in excess of that removed by evaporation, thermal decomposition, and oxidn. 14 refs. J. G. H.

1903. Lubrication of rotary high vacuum pumps. 1. A. C. Smith. *Sci. Lubric.*, 1957, **9** (10), 14–20.—Principles of design and operation of rotary high vacuum pumps are briefly described, and the relations between mechanical details and the lubrication system are discussed, together with the determination and significance of pumping speed, performance, and the effects of condensables and other contaminants. Methods of oil preservation are set out and the available types of traps described. J. G. H.

1904. Silicon analyses of diesel railroad crankcase oils. C. W. Lewis. *Lubric. Engng*, 1957, **13** (9), 505–8.—Special lubrication problems encountered in diesel locomotive operation are noted and, together with the abrasive action of silica particles, have focused attention on the analyses of use lub oils as an essential factor in determining periods between overhauls. Methods of silicon analysis are briefly indicated, and the various means by which silicon may find its way into crankcase oils are set out in some detail and the interpretation and applications of silicon analytical values discussed. 12 refs. J. G. H.

1905. Lubricating oil filtration on diesel engine railroads. W. K. Simpson. *Lubric. Engng*, 1957, **13** (8), 440–2.—The importance of effective filtration of engine oils in the successful operation of railroad diesel engines is emphasized, and special problems of filter location arising from engine design features are noted. The superiority of depth-type over surface-type filters is discussed and the interpretation of filter conditions outlined. J. G. H.

1906. Motor tests for motor vehicle lubricating oils. (In German.) W. Baist. *Erdöl u. Kohle*, 1957, **10**, 82–5.—The vigorous progressive development of I.C. engines imposes higher requirements in the quality of lubricants. The complicated phenomena in the motor can no longer be imitated in lab tests. American and European tests in sp standard motors are presented and discussed. Changes in the lubricant are observed by subsequent lab tests for visc increase, acid No. and sap. val., and resin and C formation. R. T.

1907. Chemical composition of lubricating oils, cutting oils, and petroleum solvents. W. C. Witham. *Lubric. Engng*, 1957, **13** (2), 83–4.—The chemical compcsition of straight and soluble oils as cutting fluids, lub oils, and solvents is briefly discussed. J. G. H.

1908. Predicting pressure drops in grease distribution equipment. E. F. Koenig, E. M. Johnson, and E. A. Baniak. *NLGI Spokesm.*, 1956, **20** (4), 12–19.—Extended applications of centralized lubrication systems have rendered necessary the provision of additional data on grease consistency and tube sizes for efficient flow. Details are presented of an investigation of these factors using a pressure viscometer, and a mock set-up of a centralized lubrication system carrying copper tubes of varying dia. Equipment, procedures, and products used are described, and from results obtained a correlation of pressure drop *v.* apparent visc for several greases in various units of equipment is derived and presented in the form of nomographs. J. G. H.

1909. Inorganic microgel grease performance in industrial applications. J. A. Bell. *Lubric. Engng*, 1957, **13** (9), 490–3.—The trend towards the use of multi-purpose greases is remarked, and the special properties of a new inorganic microgel grease are compared with those of lithium base greases of a corresponding type, both in lab evaluation tests and in a comprehensive series of dry and wet applications. J. G. H.

1910. New high performance grease mixer. O. L. Yarham and P. R. Sigler. *NLGI Spokesm.*, 1956, **20** (8), 14–22.—Development and special features of a radial propeller-agitated high-speed grease mixer built for Cities Service is described and illustrated, and performance data on a pilot plant installation are presented. J. G. H.

1911. Molybdenum disulphide as a grease additive. E. E. Smith. *NLGI Spokesm.*, 1956, **20** (9), 20–36.—The lubricating properties of molybdenum disulphide are outlined, and its special functions as a grease additive are indicated, with particular reference to its tendency to deposit out of greases on to metal surfaces to form durable low-friction films. Variables affecting performance of molybdenum disulphide in greases, including type of soap, additive concn, visc of contained oil, and additive particle size, are discussed in some detail. Appendixes set out detailed procedures for grease performance tests. J. G. H.

1912. Radiation damage in lubricating greases. B. W. Hotten and J. G. Carroll. *Industr. Engng Chem.*, 1958, **50** (2), 217–20.—In connexion with nuclear power plants it is important to know the effect of various exposures to radiation of lubricants. Description is given of experiments where various greases were exposed to gamma radiations and tested at given dosage intervals. The principal test used for radiation damage was the change of consistency, which is closely connected to changes in lubricating effectiveness and gel structure. 6 greases were tested. All first softened and then solidified as the dosage was increased. The silicone grease tested solidified at a lower exposure than either the mineral oil or diester oil greases used. The results are given in graphical and tabular form, and the mechanism of the structural changes is discussed. Suggestions are made for the development of radiation proof greases, the principal recommendation being the use of synthetic aromatic cpds in place of conventional gelling agents. D. K. R.

1913. Pumpability of steel mill greases. J. S. Aarons and R. G. Warren. *NLGI Spokesm.*, 1956, **20** (6), 20–4.—Increased adoption of centralized lubrication has resulted in increased emphasis being laid on the pumpability of lubricating greases and on the associated property, visc. Standard tests for these properties are described, and details are presented of a compact visc pumpability testing unit developed for use by the lubricating engineer, together with procedure details and applications of the unit to the selection of greases. J. G. H.

1914. Use of aerogels for examining structure of lubricating grease thickness. A. L. McClallan and J. Cortes. *NLGI Spokesm.*, 1956, **20** (6), 12–16.—Previous methods of examining lubricating greases by means of optical and electron microscopes have employed specimens so prepared as to present a disrupted thickener lattice. A new method of isolating the fibres so as to present these in an undisturbed state, as aerogels, is described and illustrated. 14 refs. J. G. H.

1915. Service requirements for multipurpose automotive greases. J. M. Stokely. *NLGI Spokesm.*, 1956, **20** (6), 26–31.—Advantages of multipurpose greases and desirability of their max utilization are emphasized. Lubrication requirements of the various grease-lubricated automotive parts are discussed, together with the special lubrication demands of various types of automotive services. Present inadequacy of lab tests and specifications renders desirable use of service performance as only sound basis for selection of automotive multipurpose grease. J. G. H.

1916. Equipment aspects in dispensing grease. L. C. Rotter. *NLGI Spokesm.*, 1956, **20** (6), 10–11.—Difficulties encountered in the development of grease-dispensing equipment occasioned by the earlier scarcity of basic data on greases to be dispensed are indicated, and the value of visc data for this purpose is discussed. Details are presented of equipment of a pressure viscometer type developed for the prediction of grease performance in centralized systems. J. G. H.

1917. Yield stress as a factor in the performance of greases. D. Evans, J. F. Hutton, and J. B. Matthews. *Lubric. Engng*, 1957, **13** (6), 341–6.—Dissatisfaction is expressed with standard penetration tests for greases, it being pointed out that penetration is a complex function of yield stress and visc. Details are presented of a method of measuring yield stress by means of a cone indentation test, the parameter so measured being designated the Cone Resistance Value (C.R.V.), which, for an ideal material, is related to yield stress by a numerical constant. Applications of this yield stress theory to bearing operation and to the dispensing of grease from a container by pumping are discussed, and confirm its value when measured as a function of temp as a useful property for defining grease quality. J. G. H.

BITUMEN, ASPHALT, AND TAR

1918. Improvements in the adhesion of bitumen and tar; anti-stripping agents and cationic emulsions. R. J. de Vries. *Rds & Rd Constr.*, 1957, **35** (412), 112–14.—The mechanism of mechanical and chemical adhesion is briefly surveyed, and the use of long chain amines, polyamines, and quaternary amm salts for the latter purpose is described. Methods of application, production, and economics of anti-stripping agents are discussed, together with the use of cationic bitumen emulsions. 9 refs. J. G. H.

1919. Guide to selection of coal-tar coatings for protection of materials underground. Pt 1. N. T. Shideler. *Petrol. Engr*, 1958, **30** (3), D31–5.—Underground corrosion problems of metals are outlined and the selection of coal-tar coatings discussed. Before application of the coating the metal surface should be thoroughly cleaned. 3 main varieties of coatings with varying tested properties may be applied while hot. In certain soil conditions, such as clay or rock, the coating must be protected from abrasion. A. E. R.

1920. What about additives for asphalt? W. B. Warden. *Petrol. Engr*, 1958, **30** (3), C14.—The uses of asphalt may be extended by adding small amounts of chemical additives. When asphalt is used in combination with other materials, the additive should be chosen to improve the properties of the entire finished product. The use of an additive often requires constant quality raw materials, a given manufacturing process, and a definite service use. Scientific evaluation of the correct additive is developing. A. E. R.

1921. Tailor-made asphalts. E. J. Barth. *Petrol. Engr*, 1958, **30** (3), C22–5.—The processing of constant quality asphalts for specific applications comprises high quality recovery at moderate temp to avoid splitting reactions, the removal of almost all the paraffin wax content, obtaining feed fractions of definite composition, and manufacture under controlled conditions with the exact proportioning of ingredients. Blending techniques and solvent extraction processes are mentioned. A. E. R.

1922. Design and operation of modern asphalt plants. D. W. Gagle. *Petrol. Engr*, 1958, **30** (3), C15–22.—Modern manu-

facturing and handling methods for the production of asphalt are reviewed. Improved processes of vacuum dist and solvent extraction, and the use of bulk storage and continuous automatic blending with a reduced amount of product grades, are raising the quality of asphalt. A. E. R.

1923. Progress in asphalt uses and specifications. S. H. Alexander and A. J. Hoiberg. *Petrol. Engr*, 1958, **30** (3), C11–14.—The development of specifications for road asphalts and limitations of present specifications in the U.S.A. are discussed. Asphalt may also be used for roofing, the protection of piping, and as a vapour barrier. New uses include the lining of irrigation canals or storage tanks and in the control of coastal erosion. A. E. R.

SPECIAL HYDROCARBON PRODUCTS

1924. Effect of extent of refining of power station oils on their tendency to form water-soluble acids in the initial stages of ageing. K. I. Ivanov and A. Ya. Mikhel'son. *Khim. i. Tekhonol. Topliva i Masel*, 1957, (10), 34–41.—Water-sol corrosive acids can be formed during ageing of oils even when total acidity is still very low. Mechanism of formation of such acids is reviewed. Tests were made on 3 transformer (d_{20} 0·869–0·892, cS/50° C 7·3–9·0, pour −26 to −50° C) and a turbine oil (0·900, 24·2, −50° C) using refining steps of 3% of 93½% H_2SO_4, followed by NaOH neutr and H_2O wash; oils aged with O_2 (method GOST–981/55) and total and water-sol (both volatile and non-volatile) acidity plotted. Crude type has greater effect on formation of water-sol acids than on total acidity; for all oils optimum refining (as shown by total acidity) was *ca* 12% acid, but amount of water-sol acids did not increase with further refining, except in case of one oil, containing a significant quantity of paraffin hydrocarbons (1·4% as determined by the carbamide method). V. B.

1925. Use of non-flammable liquid impregnants in electrical capacitors and transformers. F. M. Clark *et al*. *CIGRE*, 1958, Paper No. 119, 25 pp.—Properties tabulated, effect of impurities considered, and comparison with hydrocarbon oils discussed. V. B.

1926. Present-day considerations regarding transformer oil. F. O. Skala. *Electrotech. u. Maschinenb.*, 1958, **75**, 137–40.—Oxidizability of transformer oil can be countered by transformer manufacturer by O_2 exclusion (*e.g.* N_2 blanket; flexible "breathing" containers) or by oil refiner (optimum refining and blending; use of inhibitors, provided no adverse effect on other properties); opinions differ whether high elec stress justifies "gas-stable" oil, which may be less oxidn-resistant. These problems should be considered by national IEC committes, and decisions thereon taken; only then can test procedures and specification limits therefor be discussed. V. B.

1927. Report on activity of study committee on insulating oils (No. 1). H. Weiss. *CIGRE*, 1958, Paper No. 148, 4 pp (+ appendix, 7 pp).—Brief comments on matters to be discussed at 1958 session, namely, dielectric loss (results on new type cell), electric strength, sludge formation; last 2 being mainly under ægis of IEC. Appendix (J. Fabre and H. Josse) deals with influence of moisture in transformers on ageing and electric strength of paper; average H_2O in papers from power transformers was 4% (*cf*. Abs. **1854**, **1858**, 1957). V. B.

1928. Application of tg δ at audio-frequencies and increased temperatures for the evaluation of the quality of mineral insulating oils. Z. Sicinski. *CIGRE*, 1958, Paper No. 137, 19 pp.—Tg δ (p.f.) determined (at low tension) in range 30°–110° C, 50 Hz– 10 kHz, on basis that a single value measurement gives only limited information, and a much fuller picture is obtained by plotting p.f. $= \phi(t,f)$; the shape of the p.f./*f* curve varying for different oils. Comparisons between p.f. and chemical tests (acid val, sap. val, tar No.) indicate that last 2 show some broad correlation with p.f., which latter is, however, a much more sensitive index of deterioration, the low frequency value being mainly attributable to ionic constituents and that at high frequency to dipole components, such as are formed in ageing tests; hence p.f. measurements at low (50–100 Hz) frequency are suggested for new oils and at high (0·4–1 kHz) for used oils. Experimental results of tar No./p.f. comparisons are quoted, and on this basis suggested p.f. limits are (at 50° C) for new oils $\leqslant$0·004 (at 50 Hz), and for used oils (acid val $<$0·05) 0·15 (at 50 Hz) and 0·008 (at 1 kHz); for used oils having acid val $>$0·05 only a range of figures can, so far, be put forward for discussion, 0·03–0·18 (at 50 Hz) and 0·005–0·02 (at 1 kHz). V. B.

1929. Investigations on repeatability of dielectric strength evaluations by breakdown method. T. Leardini and A. de Nat. *CIGRE*, 1958, Paper No. 131, 13 pp.—Description (circuit diag) of automatic electric strength tester for oils, applying true sine wave potential at pre-determined constant (1 kV/sec) rate of rise, discharge current limited to 0·025 amp, duration $<$0·1 sec, value of max voltage before breakdown recorded. Effects of following variables studied: cell type (open, closed), interval between filling and testing (15–20 minutes recommended), interval between tests on same sample (5 minutes recommended). Electrodes were mainly Italian standard (10-mm spheres, 2·5-mm gap), also VDE; in closed cell results with both sets of electrodes were generally similar. Average strength determinable with 4 tests, which gives ±5% of average of 30 tests. V. B.

1930. Production of commercial dodecylbenzene from a narrow kerosine cut from hydrogenated Spanish shale oil. R. Martinez-Gayol. *Chim. et Industr.*, 1958, **79**, 283–9.—Cut b.p. 185°–220° C was H_2SO_4-refined then chlorinated and used for alkylating C_6H_6 or toluene ($AlCl_3$ cat) to give crude alkylate. This was sulphonated, either directly or after atm fractionation to give commercial kerylbenzene or vac fractionation to give pure dodecylbenzene. Superior quality of products is claimed to be due to greater proportion (42%) of *n*-paraffins in hydrogenated oil than in kerosine dist from petroleum. W. A. M.

DERIVED CHEMICAL PRODUCTS

1931. First U.S. Inventa plant fills slot at integrated chemical complex. C. S. Cronan. *Chem. Engng*, 1958, **65** (4), 62–4.—A new American plant using the Swiss Invicta process for making methanol is described. The synthesis gas is derived from natural gas and steam in existing plant. It is scrubbed with monoethanolamine under pressure to remove CO_2, then reacted at 5500 p.s.i. and 325°–380° C over a new cat to yield crude methanol of high purity (92–93%). P. J. O.

1932. Propylene cracks the polymer market. D. R. Cannon. *Chem. Engng*, 1958, **65** (4), 88–95.—The new processes for making polypropylene are expected to result in the creation of merchant sources for propylene, possibly from refineries in which propylene is now used solely for gasoline synthesis. Markets and possible prices of propylene derivatives, such as *iso*propanol and acetone, dodecene (propylene tetramer, for detergent manufacture), propylene oxide, acrolein, allyl alcohol, and cumene, are evaluated. Finally, the C_4 petrochemicals, *n*- and *iso*butylenes and butadiene, are briefly discussed from the standpoint of American economics. P. J. O.

1933. Aryl mercaptan output may zoom. F. Arne. *Chem. Engng*, 1958, **65** (5), 88–90.—A new process utilizes the mercaptan-rich by-product stream from a cresylic-acid refining plant to produce thiophenol, thiocresols, and thioxylenols.

It is expected that the price of these mercaptans will thereby be cut by a factor of 3 or 4, and new volume markets in pesticides, rubber chemicals, and dyes are predicted. P. J. O.

COAL, SHALE, AND PEAT

1934. Moisture's role in coal oxidation at low temperatures. (In German.) P. N. Mukherjee and A. Lahiri. *Brennst-Chemie*, 1957, **38** (3–4), 55–8.—2 coals—one of high, one of low carbonization degree—are investigated. The illustrated apparatus and testing procedure are described. The O_2 which has reacted with the coal, and the rate of decrease of atm O_2 when moist air is passed over powdered coal, are determined by exit-gas analysis. Change in the difference in O_2 cont of the entering air and the escaping gas with the time, are taken as a measure of the oxidn rate. In a moist air stream coals of high carbonization degree have a higher oxidn rate. The opposite holds good for low-carbonization coals. A change in the CO_2/CO ratio of the escaping gases indicates participation of H_2O in the reaction between coal and O_2. Many curves are presented. R. T.

1935. Benzene formation in thermal coal treatment. (In German.) G. Huck. *BrennstChemie*, 1957, **38** (3–4), 51–4.—Low-b.p. aromatics are obtained from low-temp vac dist—up to 300° C—of coals. The quantity of benzene forming up to 600° C is *ca* 0·4 kg/ton coal, and the quantity of aromatics dist up to 180° C is 4 kg. At 1000° C coking temp the benzene quantity rises to 6 kg/ton coal. This quantity might be formed to approx equal parts from phenols, higher aromatics, and neutral hydrocarbons of the low-temp-carbonization tar. Reactions occurring in the conversion of the paraffins and naphthenes of the low-temp-carbonization tar are discussed. They cannot yet be explained completely. 13 refs. R. T.

MISCELLANEOUS PRODUCTS

1936. Acetylene preparation from hydrocarbons, and the Ediger process. L. Andrussow. *Chim. et Industr.*, 1958, **79**, 432–8.—Electric (3-phase, 100–6000 V) discharge between C electrodes inserted in bed of spherical coke or coal particles, the whole immersed in hydrocarbon liq (*e.g.* fuel oil, kerosine, cracking residue, acid tar, shale oil). Millisec discharges at 0·1-sec intervals cause decomp of hydrocarbon to yield (wt %): C black (24) and gas (76); latter contains C_2H_2 (56), C_2H_4 (17), C_3H_8 (10), CH_4 (8), H_2 (8). Oil (at 100°–120° C) is recycled and filtered to remove C black. Approx consumption per kg C_2H_2: power 6·2 kWH, oil 2·8 kg. Flowsheet, outline of plant procedure, and other C_2H_2 processes are briefly discussed. V. B.

CORROSION

1937. Copper ion displacement test for screening corrosion inhibitors. W. B. Hughes. *J. Petrol. Tech.*, Jan. 1958, **10** (1), 54–6.—The test uses the property that metal ions will be displaced from solution by metals having a more positive electrode potential. Thus an active iron surface in a solution of a copper salt will have copper deposited on it if iron goes into solution. Iron passified by coating with an inhibitor is no longer capable of displacing copper.

1-inch square sand-blasted coupons made from 0·006-inch thick shim stock are immersed in brine from the corrosive source for 5 minutes, then transferred wet to a solution of known concn of the inhibitor in oil from the corrosive source for 5 minutes. Next they are put in 10% $CuSO_4$ soln for ½ minute. Blank determinations are made without the inhibitor. The lowest concn of inhibitor required to prevent copper deposition is taken as passing the inhibitor. The method is suitable for selection from known inhibitors; it does not replace other evaluation tests. The test time is less than occurs in the field. However, in a series of field tests the best inhibitor was that indicated by the coupon tests.

Fluids shipped to a lab may suffer changes.

The test has been found to correlate closely with weight loss tests. G. D. H.

1938. Cathodic protection may boost corrosion. C. Breckon. *Petrol. Refin.*, 1958, **37** (3), 189–90.—The use of cathodic protection by means of both sacrificial anodes and impressed current is briefly discussed, with special reference to heat exchanger tubes. The author stresses that care must be taken in the extension of this type of protection to ensure that the result obtained is not in fact the opposite of that which is desired. The evidence from many practical installations in widely different conditions shows that sacrificial iron anodes are the best material to use for the protection of copper alloy heat exchanger tubes. Results also show that, in the case of impressed current protection, risk of tube damage is minimized by the use of soluble iron anodes rather than insoluble ones, although more frequent replacement would be necessary. J. R. T.

1939. Right material cuts pump corrosion. R. B. Norden. *Chem. Engng*, 1958, **65** (5), 162–6.—The various types of corrosion which occur in centrifugal pumps are described and illustrated, and methods of prevention are discussed. P. J. O.

1940. Aqueous-amine acid—removal process need not be corrosive. J. S. Connors. *Oil Gas J.*, 3.3.58, **56** (9), 100.—Design details are given to minimize corrosion, using carbon-steel equipment. Chemical reactions involved in relation between alk-anolamines and acid gases are discussed, a description of the amine-gas purifier process given, and operation factors dealt with. G. A. C.

1941. Use of coal tar coating for underground corrosion mitigation. F. J. Kierman. *Pipe Line News*, Dec. 1957, **29** (12), 58–67.—3 main types of underground corrosion are generally recognized, *i.e.* (1) electrolytic corrosion, caused by external sources of direct current generation; (2) galvanic corrosion, caused by the combining of metal with chemicals dissolved in the soil; (3) biochemical corrosion. 6 main factors that effect the corrosivity of soil are given, and the electrochemical theory of underground corrosion is briefly stated. Corrosion can be mitigated by preventing the contact between metal and electrolyte by a protective coating. The history, qualities, and advantages of coal tar for this protective coating are given, and the various methods of application employed and developed during the last 50 years are also described and discussed. D. K. R.

SAFETY PRECAUTIONS

1942. Composition and action of protective ointments. J. M. Shaw. *Lubric. Engng*, 1957, **13** (6), 347.—The general body of barrier creams are classified in 4 groups, their functions and limitations being briefly discussed. Methods of evaluation are outlined, and the superior performance of some of the new silicone-containing ointments is indicated. J. G H.

1943. Structural and operative safety measures, causes and location of fires in mineral oil refineries. (In German.) H. D. Spohn. *Erdöl u. Kohle*, 1957, **10**, 85–90.—Every phase of transport on land and water, storage, and refinery operations is discussed in relation to fire-hazards and safety precautions. The nature and application of quenching media and effective location of fire appliances are described. R. T.

1944. Procedures on rupture disk installations. J. E. Bigham. *Chem. Engng*, 1958, **65** (7), 143–5.—The positioning and choice of bursting disks are discussed, with recommendations on their use in conjunction with relief valves. The sizing of the bursting disk and its installation, the effect of corrosion, and possible back pressure from vent lines, etc., are also discussed. P. J. O.

ECONOMICS AND MARKETING

1945. World petroleum statistics, 1956. Anon. *Inst. Petrol. Rev.*, 1958, **12** (136), 118–23.—4 tables containing world statistics of: (1) details of production, imports, exports, crude runs, and stock changes for crude petroleum; (2) production of major refined products; (3) bunker oil deliveries to ships in international trade; (4) estimated demand of major refined products. E. M. I.

1946. What a petroleum economist does. S. B. Jurenev. *Petrol. Engr*, 1958, **30** (3), E5–10.—The function of an economist in an oil company is described. Problems of co-ordination committees and the way an economist and his staff aid in choosing favourable solutions are outlined. Organization of an economic advisory unit, and hints on the selection, maintenance, and training of staff are given. A. E. R.

MISCELLANEOUS

1947. Applied hydrocarbon thermodynamics. Pt 2. A review of *P–V–T* data correlations. W. C. Edmister. *Petrol. Refin.*, 1958, **37** (2), 123–30.—Many applications of thermodynamics to hydrocarbon systems of interest to process engineers, such as calculation of densities of compressible fluids, require *P–T–V* data or correlations. This article discusses equations of state, the perfect gas law, compressibility factor, Boyle temp, and *P–V–T* plots. Estimation of densities of mixtures by use of the compressibility factor is outlined. 3 equations of state used in correlating *P–V–T* data and calculation of thermodynamic properties, namely, the van der Waal, Berthelot, and Redlich–Kwong equations, are presented. Other graphical *P–V–T* correlations, such as the reduced isochor plot or the reduced vol residual, are described. J. R. T.

1948. The shaker bomb. J. W. Payne, C. W. Streed, and E. R. Kent. *Industr. Engng Chem.*, 1958, **50** (1), 47–52.—This piece of apparatus was designed to obtain data on thermal processes at temp of 800° C and above and at pressures of up to 3000 p.s.i.g. much more quickly and less expensively than with conventional pilot plants. The high pressure " bomb " is heated by an induction coil and cooled by water sprays, giving a very quick temp response. It is agitated by being attached to the piston of a reciprocating engine which is driven by an electric motor at speeds between 20 and 2000 strokes/minute. The design and operation of the shaker " bomb " are described, and some illustrations are given of the type of information obtainable by using it. D. K. R.

1949. Predicting convergence pressure. J. M. Lenoir and G. A. White. *Petrol. Refin.*, 1958, **37** (3), 173–9.—The use of convergence pressures to establish equilibrium ratios has the advantage that it takes into account the effect of composition on the equilibrium ratio. The authors present a series of charts which are used in a graphical method for predicting equilibrium constants of multi-component mixtures over a wide range of temp and pressure. The method is applicable to various mixtures, including paraffins, olefins, naphthenes, aromatics, and non-hydrocarbons which normally occur in hydrocarbon mixtures. Several examples are included to illustrate the use of the charts. J. R. T.

1950. How much mixing occurs in a pipe? O. Levenspiel. *Petrol. Refin.*, 1958, **37** (3), 191–4.—When products are moved around the refinery, one line can be used to handle a variety of materials. These materials are transported successively, and switching from one to another forms a zone of contamination between the 2. The author presents a series of charts in which this zone of contamination is related to a dispersion number and the pipe dimensions. The dispersion number in turn is obtained from a correlation with Reynolds No. Several worked problems are presented to illustrate the use of these charts. J. R. T.

1951. Measure vapour losses with radioisotopes. A. J. Brandel and D. E. Hull. *Petrol. Refin.*, 1958, **37** (3), 195–6.—A method for measuring rates of loss of gases from confined spaces by determination of the rate of disappearance of a radioactive tracer is described. The radioactive gas or vapour is added to the space and the concn of radioactive material is measured as a function of time by conventional counting methods. A graph of concn of radioactive material against time yields the rate of loss which, together with the known vol of the enclosed space and the displacement rate, allows calculation of the volumetric rate of loss. J. R. T.

1952. Review patent fundamentals. R. G. Crooks. *Chem. Engng*, 1958, **65** (4), 121–36.—American patent law is surveyed, patentable inventions discussed, and methods of preparing patent applications, turning patents into profit, enforcing and protecting patents, and safeguarding secrets are described. P. J. O.

1953. Solve second-order linear equations. S. Danatos. *Chem. Engng*, 1958, **65** (4), 145–50.—Differential equations commonly used in refinery calculations are treated in this article, 6th and last in a refresher series. Problems dealt with include flow from tanks, effect of damping on stability of process control, and temp distribution along a heated rod. P. J. O.

1954. Heat recovery and pollution removal by catalytic combustion. A. R. Myhill. *Mech. World*, 1958, **138** (3465), 160–2.—This describes the application of cat combustion to imflammable gases and vapours from furnaces, ovens, etc., to

avoid air pollution and to enable the products of combustion to be used in preheating the plant. E. M. I.

1955. Transparent models crack gas-flow mysteries. C. S. Cronan. *Chem. Engng*, 1958, **65** (6), 70–2.—The use of $\frac{1}{16}$ scale Perspex models to study gas flow in ducts, etc., is described. The method is claimed to result in savings in outlay on fans and motors through lower pressure brought about by detail changes in duct design. Smoke trails and velocity profile measurements are used to study flow in the model. P. J. O.

1956. Evolution of automation in the oil industry. S. W. J. Wallis. *Fluid Handl.*, 1958, 123–5; *Instr. Pract.*, 1958, **12**, 627–31.—The oil industry has already developed a high degree of automatic control, and it is unlikely that automation will result in manpower savings. Automation can give increased eff of plant operation, but its use is limited by lack of knowledge of plant dynamics. Possible future applications of automation to line blending, measurement of oil stocks, and transfers are considered. W. A. M.

1957. So you want to be a petroleum engineer? H. H. Power. *Petrol. Engr*, 1958, **30** (1), E3–5.—The development of the study of petroleum engineering over the last 45 years in the U.S.A. is outlined. An undergraduate university curriculum is set out which would provide 5 years of study. At present, research leading to a doctorate in petroleum engineering is rarely pursued, although graduate teaching at the master's level appears to provide little difficulty. 8 refs. A. E. R.

1958. Suez crisis spurs hunt for new energy sources. E. Eltham. *World Petrol.*, 1957, **28** (12), 89.—Resources of conventional forms of energy such as coal, oil, and hydroelectric power are briefly considered and some of the proposals for new sources of energy discussed. In Europe plans for greater use of atomic energy are being accelerated, and in England it is estimated that there will be an atomic power demand nearly equal to oil by 1975. In Euratom countries it is planned to produce 15 million kW from atomic energy in 1967 and in the U.S.A. 24 plants have been planned to provide atomic energy equivalent to 27 million brl of oil by 1965. It is, however, estimated that, during the next one or 2 generations, atomic power development will only help to supply the increasing power needs and the demand for fossil fuels will continue to increase. C. A. F.

1959. Petroleum industry and research in the Benelux countries. R. Gillerot. *Bull. Ass. franç. Tech. Pétrole*, 1958, 109–25.—Account of facilities in Belgium and Holland for import, production, and refining of petroleum and for petroleum research. Tables give location, production, and scope of Dutch and Belgian refineries. W. A. M.

1960. Gearing for to-morrow's octanes. W. J. Service, R. E. Payne, and W. E. Askey. *Oil Gas J.*, 14.4.58, **56** (15), 90.—An economic survey is given of cost of producing motor gasoline with predicted octane quality requirements (104·5 and 97·5) through 1963 using currently available commercial processes. G. A. C.

1961. Data handling and computing. Anon. *Petrol. Times*, 25.4.58, **62** (1584), 354.—A review is given of recent applications in refineries in the U.S.A. of automatic data processing and computing machines, practical applications include payroll preparation, purchasing, accounting, processing of analyses of hydrocarbon gases, and mass spectrometer analysis. G. A. C.

1962. Where are petrochemicals headed? W. E. Kuhn. *Oil Gas J.*, 3.3.58, **56** (9), 95.—Raw materials sources and their costs are discussed. It is estimated that petrochemical production will increase more than 100% by 1965, and *ca* 50% of the raw materials originate from refinery operations, the remainder coming from natural gas and LPG. Supplies from these sources are thought to be adequate. G. A. C.

BOOK REVIEWS

Chemical Engineering Practice. Vol. 4. Fluid State. Ed. Herbert W. Cremer and Trefor Davies. London: Butterworths Scientific Publications, 1957. Pp. 623 + vi. 95*s*.

The fourth volume of this series of twelve is devoted to thermodynamic and physical properties of systems, fluid flow, and measurement of process variables.

The first section of the book covers the usual text-book field of physical thermodynamics. However, the treatment is very effective in that the underlying importance of this branch of knowledge and practical applications to process studies are well presented. System equilibrium conditions are developed as a concept of chemical potential and with reference to the phase rule. The usual relationships between intensive and extensive properties are discussed and applications of the Gibbs–Duhem equation are considered. The many system properties used in engineering calculations are illustrated for single substances and binary mixtures. Presumably, multi-component systems are eliminated on account of space limitations. The chapter on sum and difference properties is a useful but an odd collection of facts, many of which should be covered in detail in later sections of the work.

The largest part of the book is devoted to aspects of fluid flow. The treatment of flow and energy equations has continuity with the thermodynamics section. Fluid dynamics are first considered for frictionless fluids, and later the effect of viscosity is introduced, as in the Navier–Stokes equations. Consideration of turbulent flow and the boundary layer leads to applications of dimensional analysis and concept of dynamic similarity. There are two chapters of a somewhat less theoretical nature on flow within tubes and ducts and flow around objects and these have useful references. The chapter on compressible fluids is largely concerned with flow through nozzles.

The volume is concluded with a chapter on the measurement of process variables, dealing specifically with pressure, fluid flow, liquid level, and temperature. This is largely a descriptive introduction to instrumentation.

Many of the topics dealt with in this volume are of a theoretical and mathematical nature, and there is much compression of material. In spite of these difficulties the text is agreeably readable. L. G. M.

Proceedings of International Congress of Combustion Engines. Zurich: Swiss Association of Machinery Manufacturers, 1957. S. Fr. 65.

In this era of international conferences it is inevitable that some should be better than others. The Fourth International Congress of Combustion Engines in Zurich was attended by nearly 1000 delegates and their guests, and most of them would probably agree that it was a success, both from the point of view of organization and the technical worth of the 25 papers from 10 different countries. Of these, 18 related to diesel engines and 7 to the gas turbine. The theme of the Congress was " supercharged diesel engines and gas turbines in the various fields of application: marine propulsion, traction, and power stations."

Most of the papers are printed in English, and where French is used there are summaries in English; the graphs and illustrations are commendably clear, and altogether there are some 800 pages of technical material. They record some remarkable advances in diesel performance, perhaps stimulated by the growing threat of competition from the gas turbine. For example, in a review of M.A.N. work on high-pressure-charged diesel engines, Professor Sörensen reports successful operation of a 9·5-inch bore trunk piston engine at b.m.e.p. up to 230 p.s.i. at which the maximum firing pressure was 1800 p.s.i. In the M.A.N. system exhaust temperatures are kept below 600° C to minimize the thermal stresses, and the temperature of the light alloy piston does not exceed 250° C at the centre of the crown, even with a b.m.e.p. of 250 p.s.i. It is considered that operation on a b.m.e.p. of 20 kg/cm² (284 p.s.i.) does not present any fundamental problems. A paper by Herger and Jenny of Brown Boveri stimulated a good discussion of turbo-charging which included three British speakers. Gasquet, in another paper, finds economic advantages in the use of turbo-charged engines for oil tankers.

If the designer wishes to avoid increased mechanical stresses in pressure-charged engines he must accept a higher cylinder exhaust temperature and consequently greater thermal stresses; the distribution of heat flow in high duty I.C. engines is discussed in a paper by Alcock. The remaining two British papers deal with the gas turbine. Dr T. W. F. Brown reviews the development of the long-life marine gas turbine and discusses the problems of burning low grade fuels. Practical experience with the use of additives in residual fuels is summarized in a paper by W. Tipler, who foresees no early and universal solution of the problem of ash deposition and blade corrosion. The combustion processes in gas turbines are analysed by Millan and Sanz of Madrid.

There are a number of other excellent papers which cannot be mentioned for lack of space, together with an introductory address by Professor Traupel; in this he compares the reciprocating engine and turbine thermodynamically and shows that the two kinds of prime mover must develop in parallel. The idea of "continuous and discontinuous flow engines in association and competition" is taken further by Maurice Roy in a thoughtful review which completed the technical sessions. Undoubtedly this volume is a work of reference which should be within reach of everyone in the petroleum industry who is concerned with diesel or gas turbine problems. K. A.

ADDITIONS TO THE LIBRARY

Entries are in subject order arranged according to the Uren "Classification for Petroleum Bibliography," the number preceding each entry indicating the classification and corresponding to that used in the "Library Catalogue" published by the Institute.

000 FLOHERTY, J. J. Flowing gold. 2nd edition. Philadelphia, Lippincott, 1957. 224 p.

040 LEWIS, H. K., AND CO. LTD., *publishers*. Catalogue of Lewis' medical, scientific and technical lending library . . . new edition revised to 31 December 1956. London, H. K. Lewis, 1957. 1178 p.

040 NATIONAL PETROLEUM BIBLIOGRAPHY. Petroleum sourcebook 1958: a regional bibliography of petroleum information. Texas, National petroleum bibliography, 1958. 179 p.

080 THE ANGLO-AMERICAN YEAR BOOK 1957. 45th edition. London, American chamber of commerce, 1957. 570 p.

080 THE REGISTER OF THE GAS INDUSTRY 1958. London, Arrow press, 1958. 266 p.

090 BRITISH STANDARDS INSTITUTION. Sampling and examination of bituminous mixtures for roads and buildings. London, B.S.I., 1958. 54 p. (BS 598: 1958.)

090 BRITISH STANDARDS INSTITUTION. Dimensions of carburettor output flanges. London, B.S.I., 1958. 13 p. (BS 2985 : 1958.)

090 BRITISH STANDARDS INSTITUTION. Wrought iron and mild steel hooks. London, B.S.I., 1958. 40 p. (BS 482 : 1958.)

090 BRITISH STANDARDS INSTITUTION. Oil resistant compressed asbestos fibre jointing. London, B.S.I., 1958. 23 p. (BS 1832 : 1958.)

090 BRITISH STANDARDS INSTITUTION. Meteorological thermometers. London, B.S.I., 1958. 17 p. (BS 692 : 1958.)

090 BRITISH STANDARDS INSTITUTION. Rolled asphalt. London, B.S.I., 1958. 43 p. (BS 594 : 1958.)

090 BRITISH STANDARDS INSTITUTION. Drawing instruments for drawing office use. London, B.S.I., 1958. 15 p. (BS 1709 : 1958.)

090 BRITISH STANDARDS INSTITUTION. Bordeaux connections. London, B.S.I., 1958. 19 p. (BS 461: 1958.)

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090 BRITISH STANDARDS INSTITUTION. Drop-forged sockets for wire ropes for general engineering purposes. London, B.S.I., 1958. 18 p. (BS 463 : 1958.)

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090 BRITISH STANDARDS INSTITUTION. Rigging screws and stretching screws for general engineering purposes. London, B.S.I., 1958. 31 p. (BS 716: 1958.)

090 BRITISH STANDARDS INSTITUTION. Wire rope slings and sling legs. London, B.S.I., 1958. 51 p. (BS 1290 : 1958.)

090 BRITISH STANDARDS INSTITUTION. Glossary of terms used in high vacuum technology. London, B.S.I., 1958. 29 p. (BS 2951 : 1958.)

090 BRITISH STANDARDS INSTITUTION. Domestic lighting appliances for use with butane/propane gases, Part 1: appliances for use with butane gas. London, B.S.I., 1958. 13 p. (BS 2977; Part 1 : 1958.)

090 COUNCIL OF BRITISH MANUFACTURERS OF PETROLEUM EQUIPMENT. Chairman's report on the work of the Council, July–December 1957. London, CBMPE, (1958). 21 p.

140 CHENEY, M. S. Big oilman from Arabia. London, Heinemann, 1958. 320 p.

200 THE VAN NOSTRAND CHEMIST'S DICTIONARY. London, Macmillan, 1954. 761 p.

220 COLLIER, C. H. *editor*. Catalysis in practice. New York, Reinhold, 1957. 153 p.

220 EMMET, P. H. Catalysis. Volumes 3, 4, 5. New York, Reinhold, 1955.

230 GAYDON, A. G. The spectroscopy of flames. London, Chapman & Hall, 1957. 279 p.

500 PIRSON, S. J. Oil reservoir engineering. 2nd edition. New York, McGraw-Hill, 1958. 735 p.

610 WOOLER, R. G. Tankerman's handbook. 3rd edition. New York, Edward W. Sweetman, 1956. 278 p.

700 NELSON, W. L. Petroleum refinery engineering. 4th edition. New York, McGraw-Hill, 1958. 960 p.

710 SHELL-MEX AND B.P. LTD. Pride in progress. London, Shell-Mex and B.P. Ltd., 1957. 15 p.

750 ASSOCIATED ETHYL COMPANY LTD. World-wide survey of motor gasoline quality. London, Associated Ethyl Co. Ltd., 1958. 76 p.

800 WARD, E. R. The use of light petroleum distillate for gas making. London, Institution of gas engineers, 1957. 15 p.

810 LUCAS, G. *and* POLLOCK, J. F. Gas turbine materials: a survey of high-temperature materials and their application to the gas turbine. London, Temple press, 1957. 163 p.

890 FISHER, H. L. Chemistry of natural and synthetic rubbers. New York, Reinhold, 1957. 208 p.

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OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

1963. Quantitative photogeology—popular exploration tool. L. Brundall and V. Jackson. *World Oil*, 1958, **146** (4), 85.—In recent years photogeology has developed as an important tool in exploration, but to date its use has been mainly qualitative, for: (1) broad regional interpretation; (2) fairly detailed exploration with medium-scale photography; (3) very detailed interpretation with large scale coverage; and (4) geomorphological interpretation. Refinements in plotting instruments have, however, led to the use of aerial photographs for quantitative purposes. It is now possible to prepare photogrammetrically structural contour maps, profiles, and isopachyte maps, and the methods can be used in hydrodynamic studies.

2 main types of plotting instruments are available, each of which is based on the principle of parallactic displacement and uses a floating dot within a stereoscopic model. In the first type an overlapping pair of photos is viewed through simple to complex arrangements of stereoscopes; instruments range from the simple parallax-bar to plotters with a high order of accuracy. In the second an anaglyphic projection of stereo pairs is obtained, and several instruments of this type are available. These are briefly described with accompanying photographs. C. A. F.

1964. Detection of very deep discontinuity surfaces by seismic reflection. (In German.) G. Dohr. *Erdöl u. Kohle*, 1957, **10**, 278–81.—Results of seismic measurements—described and recorded in charts—from the Nahe–Senke region and the

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spaces Rastatt–Achern, Baden–Oos, Bühl, and Murnau, indicate the possibility of detecting discontinuity surfaces and postulating the extensive course of these zones. 12 refs.
R. T.

1965. Geological features of Peru. J. E. Rassmus. *Petrol. Engr*, 1958, **30** (4), B26–31.—Peru may be divided into 3 physiographic areas: the coast, the Andes, and the Amazon basin. The coastal area produces most of the country's commercial oil from Tertiary deposits. Commercial oil accumulation in the Andean region is improbable due to the greatly distorted tectonical structure. The Amazon basin is considered to possess large deposits of oil and exploration is active, despite difficult access to the jungle-covered region.
A. E. R.

1966. Petroleum geology of Eastern Peru . . . to-day. W. Ruegg. *Petrol. Engr*, 1958, **30** (4), B32–42.—The petroleum geology of the E. region of Peru, including the Amazon basin, is described in detail. This region is made up of 3 main units and 2 separate basins exist. A. E. R.

1967. Wild well flows oil in Iran. Anon. *Oil Gas J.*, 12.5.58, **56** (19), 97.—The wildcat Ahwaz 6, Iran, blew out and caught fire on 19.4.58 following a coring operation at 8093 ft. Gas flowed at estimated rate of 100 million cu. ft/day, and the well also started flowing oil during the first week in May. M. Kinley has made preparations for extinguishing the fire using explosives. 5 earlier tests on the Ahwaz structure failed through mechanical difficulties caused by shifting subsurface formations. J. C. M. T.

1968. Uganda, geological study. (In French.) N. Harris, J. W. Pallister, and J. M. Brown. *Rev. Petrolière*, Feb. 1957, (988), 21–4.—Surface indications of gas and petroleum—associated with lacustrine sediments of sweet water of Plio-Pleistocene age—have been found on the Uganda and Belgian Congo sides of the Lake Albert depression in W. Uganda. These exudations, dispersed along the entire shore, presuppose the existence of economical quantities of petroleum. According to borings to the crystalline base, the sediments at the NE. extremity of the lake are over 4000 ft thick. Drilling has taken place at Walki near Butaiba at the NE. extremity of Lake Albert; at Kibiro oil exudation, *ca* 15 miles SW. from Butaiba; near the Kibuku oil exudation in Semliki river valley; and at the N. extremity of the Ruwenzori chain. Kibiro petroleum is asphaltic; Kibuku petroleum-impregnated sand contains a more paraffinic variety. An oil–water emulsion has been found in the fault zone which marks the depression border. The oil appears to be retained against the fault zone in low-porosity sand. The recognized existence of petroliferous schists in depth at the Butaiba extremity of Lake Albert appears to justify new researches near Kibuku. The only marked horizon clearly known in the Plio-Pleistocene series is the Kaiso bone bed, which could be made to correspond to the intermediate stage of the Congo Kaiso series. It is possible that, at Waki, the whole succession may be below the Kaiso bone bed horizon, but some Kilburi wells commence in quaternary fluvialite deposits, which could not be placed below the bone bed. Unless all the Kibuku series are entirely below the bone bed horizon it must be supposed that a continuous sedimentation of Kaiso beds has occurred in the low Semliki valley. R. T.

1969. Petrographic and facial formation of the Schleswig-Holstein Dogger sands. (In German.) G. Rüddiger. *Erdöl u. Kohle*, 1957, **10**, 349–55.—Profiles—almost completely Dogger—drilled in the Schleswig-Holstein Jurassic synclines show, in all stages—excepting the Lower Aalénian—sand flows, the important petrographic and facial formation features of which are described. Almost all sections of the Dogger sand horizons of the E. syncline show sand thickness reductions towards the S., combined preponderantly with average grain size decrease. Ore bearing, already beginning in the N. of the syncline, in the sands of the Upper-Dogger γ, sets in later towards S. and fails completely in the S. Conformities exist between sands of E. and W. synclines, *e.g.* the iron ore peak lies in Dogger δ in both. The heavy mineral cont consists of a zirconium–tourmaline–rutile and a garnet–staurolite–epidot flow. Both are noticeable at the same time in the two synclines. The habitat of the Dogger-Sands is discussed. It is probably the more northerly region of the surrounding Triassic fault blocks with the Rhætic overburden.
R. T.

1970. Paris basin of Central France scene of major oil discovery. J. A. Kornfeld. *Petrol. Engr*, 1958, **30** (4), B129–31.—A wildcat on the Meaux anticline has indicated considerable production from 70 ft of oolitic saturated limestone at 6000 ft of Upper Jurassic age. The Meaux anticline is extensive, with prospects of production up to 10,000 ft. A. E. R.

1971. New oilfield reported discovered in Moldavia. Anon. *World Oil*, 1958, **146** (2), 104.—New oil deposits are reported to have been found in Moldavia in the Kishinov area. The structure is said to be similar to Ploesti in Rumania and depths are from 1150 to 1650 ft. C. A. F.

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

1972. 22 Lorac stations guide seismic surveys in Gulf of Mexico. J. W. Calvert. *World Petrol.*, 1958, **29** (3), 46.—The Lorac positioning system has proved an invaluable means of offshore surveying, and in the Gulf of Mexico there are now 22 land stations; 3 in Florida, 10 in Louisiana, and 9 in Texas. The principle of the system involves measuring the phase difference of radio waves received from 2 continuous-wave land-based transmitters. The intersection of the 2 position lines gives the position of the vessel at any time. Details of the method are given. In the Gulf the stations are used in 7 networks, A to G, and the advantage over the radar method is that the frequencies used follow the earth's curvature, so that signals can be received beyond horizon distance. C. A. F.

1973. Sahara seismic operations. A. D. Waldie. *World Petrol.*, 1958, **29** (3), 42.—Seismic work in the Algerian Sahara region began in 1946, and many techniques have been used since then. Conventional methods, usually successful elsewhere, have in general not given the desired results; a low signal–noise ratio is the usual condition in the area, and this needs a high multiplication factor to obtain seismic records of usable quality. Recently the weight-dropping method has been introduced; this has been successful and is now being used commercially.

In this technique successive drops of the weight are made at *ca* 12 sec intervals, and each is recorded in sequence on a multi-drum tape recorder which simultaneously records data from the detectors. The data are then processed in head office.

Remoteness of locations, water shortage, and instability of sandy soil provide acute transport problems. C. A. F.

DRILLING

1974. Rig accidents—causes and remedies. Anon. *World Oil*, 1958, **146** (4), 99.—Some of the most frequent types of accidents on drilling rigs are briefly discussed. Most of these

are due to dangerous working practices due to flying, falling, or surging objects. A series of cases emphasizes the importance of the safety hat on the rig, and 5 simple rules which would reduce accidents appreciably are given. C. A. F.

1975. New method cuts rig time. D. L. Farley and H. E. Schwegman. *Petrol. Engr*, 1958, **30** (1), B69–74.—Considerable reductions in rig time involved in well evaluation and completion operations have been made by a new method which elimates round trips with tubing or drill pipe. The method uses a new retrievable valve tester with a multi-purpose packer which enables the performance of several operations, such as formation testing, squeeze cementing, treating, and perforating for only one trip with the tubing. Similar bottom-hole control to that of conventional equipment is obtained. A. E. R.

1976. " Run-around " provides " soft " drive for rotary table. J. N. Schuelke. *World Oil*, 1958, **146** (4), 102.—A new low h.p. " soft " drive for the rotary table and drawworks is briefly described. It is designed for rigs of 2000 h.p. and consists of a 24-inch hydraulic coupling drive from the main compound. It by-passes the master clutch and provides 250 h.p. for table and drawworks accessory drive. It has scoop control and an independent tube heat exchanger mounted adjacent to the coupling. A diagram and photograph show the equipment. C. A. F.

1977. Instrument pinpoints lost circulation. Anon. *World Oil*, 1958, **146** (4), 104.—A wireline lost circulation detector is available which promises to save considerable rig time. It consists of a thin-walled cyl, 4½ inches i.d. At the top are large vents which admit drilling fluid, and at the bottom it is open through a 1½-inch swedge. When fluid moves down through the cyl the flow is restricted by the swedge, and pressure which builds up inside moves a diaphragm whose change of position is detected electrically at the surface. Readings are taken down the hole until no flow through the device can be detected. It will operate in any conductive drilling fluid. C. A. F.

1978. Inverted emulsion cement. Anon. *Drilling*, May 1958, **19** (7), 71.—A new cement developed by Magnolia Petroleum Co. has a liq phase consisting of an emulsion of water droplets in a continuous oil phase. When cement is added it remains in the oil phase, and no hydration occurs until the fluid is pumped into position in the well, when the higher temp breaks down the emulsion. Thus premature setting is prevented; also damage to water-sensitive formations is reduced or eliminated. J. C. M. T.

1979. First report on weight/speed/penetration study. A. Lubinski *et al*. *Petrol. Engr*, 1958, **30** (1), B40–52.—Drilling data from daily drilling reports proved inadequate for analysis due to the large deviation from the mean values. A programme of controlled tests using trained engineer observers was set up. Drilling variables and rate of penetration were continuously recorded. Formation changes occurred often during each test, and formation drillability varied greatly between tests, so that the relative drilling rate was used to combine the results. It was found that the relative drilling rate was approx proportional to the bit weight to the power 1.2, for both toothed and carbide-studded bits. Rotary speed at constant bit weight was found to increase the relative drilling rate, but the effect considerably decreased with higher rotary speeds and lower bit weights. A method is proposed which should permit the determination of an entire rate–weight curve over a very short interval of distance, using recordings in drilling-off periods, thus increasing the probability of formation homogeneity and reducing the number and cost of experiments. A. E. R.

1980. Washington well produces hard rock drilling lesson. Anon. *Drilling*, May 1958, **19** (7), 65–7.—1 Rattlesnake, Benton County, Washington, was drilled through 10,655 ft in 220 days in hard basalt formations. Carbide insert bits, and air, aerated, and mud drilling were employed. Air drilling with 2000 cu. ft/min circulation was used until water penetration caused difficulties. Aerated drilling using lime water and sodium dichromate in water at the rate of 125–250 gal/min and 2000 cu. ft/min air was then used. Fluid loss and heading of returns were combated by the addition of mud and lost circulation material at intervals. Below 4847 ft the air was reduced to an amount required to balance lost circulation only, and stopped at 5296 ft, drilling being completed with mud to 10,655 ft. Rotary speeds were 55–90 rev/min, and bit weights 4000–24,000 lb. At optimum speed of 55–60 rev/min bit life averaged 700–850 ton-hr. Fastest penetration and lowest bit wear were obtained with air. J. C. M. T.

1981. Induction-electrical logging in Oklahoma. H. W. True. *World Oil*, 1958, **146** (4), 108.—The combined induction-electrical log is gradually replacing the conventional electrical log in Oklahoma. It consists of an S.P., conductivity, reciprocated conductivity, and short normal resistivity logs, and has many advantages over the conventional log. The use of the induction log provides in general better determination of true resistivity and bed definition. The principle of induction logging is outlined, together with the methods of interpretation. Some field examples are given with diagrams. 3 refs. C. A. F.

1982. Surface gamma ray logging of subsurface cores. R. E. Jenkins and M. C. Meurer. *Petrol. Engr*, 1958, **30** (2), B64–70.—A new technique involves monitoring the γ radioactivity level of subsurface cores after removal from wells. Comparison of the surface core with a conventional γ-ray log provides data enabling the identification of lithology, the determination of the proper depth from which cores are taken so that the perforation of thin producing sections and laminated intervals is accurate, the location of intervals where cores are missing, and the accurate identification of formation boundaries as an aid in determining reserve estimates. A. E. R.

1983. A fundamental approach to well bore stabilization. W. J. Weiss, R. H. Graves, and W. L. Hall. *Petrol. Engr*, 1958, **30** (4), B43–60.—The depth attainable in deep wells has been limited and drilling costs greatly increased due to troublesome shale sections. Conventional muds wash out weaker shales, and the harder unsupported sections left fall into the hole, often causing the drill pipe to stick. The shales which cause this effect are called " heaving shales " and are generally hard and brittle. Self-dispersing shales soften and lose strength in contact with filtrates from high pH limed muds and electrolytes. Sodium silicate muds solidify weak shales and increase mechanical and chemical stability. A mud system having the latter properties was developed, being inexpensive, simple to control, and safe to use. Selected well data are given showing that well bore stabilization has reduced mud costs and drilling problems, and enables penetration of very difficult shale sections. A. E. R.

PRODUCTION

1984. Determining the oil–water contact from production data. F. W. Cole. *World Oil*, 1958, **146** (2), 93.—The oil–water contact has been defined, and in many cases it is useful to know how it changes during reservoir production. One

method of determining this is described, and it makes use of the Darcy flow equation. It can be shown that:

$$\frac{L_o}{L_w} = \frac{Q_{os}}{Q_w}\frac{\mu_o}{\mu_w}\frac{K_w}{K_o}\beta, \text{ and } L_T = L_o + L_w$$

where L_o = thickness of original oil reservoir flowing oil;
L_w = thickness of original oil reservoir flowing water;
L_T = total thickness of original oil reservoir;
Q_{os} = surface oil flow rate;
Q_w = water flow rate;
μ_o = reservoir oil visc;
μ_w = reservoir water visc;
K_w = effective permeability to water;
K_o = effective permeability to oil;
β = formation vol factor of oil.

If mobility characteristics of the fluids and shrinkage are known, then the position of the oil–water contact can be determined from these formulæ. It is assumed in their derivation that there is no water coning and no transition zone where water and oil are flowing. C. A. F.

1985. Workover costs reduced with concentric tubing tool. R. J. Goeken. *World Oil*, 1958, **146** (4), 135.—A workover method is described in which small o.d. tubing is used as a tool for well completions. It has been successful in sand removal, squeeze-cementing, displacement plug cementing, acidizing, and other operations. It is estimated that there have been net savings of $352,755 on 71 jobs, based on conventional rig costs. Requirements for concentric tubing workovers are discussed, together with details of the techniques. The basic equipment consists of: (1) a tubing string of sufficient length and clearance to run within the producing string to the required depth; (2) blowout preventer; and (3) a pulling unit with high-pressure pump, manifold, and measuring tanks.

Diagrams show workover methods, and a table giving the results of field workovers in Louisiana is given. C. A. F.

1986. Non-graphical solution of back-pressure tests on gas wells. H. N. Dunning, R. W. Smith, and C. J. Walker. *Petrol. Engr*, 1958, **30** (1), B77–80.—The results of standard back-pressure tests of gas wells may be used to calculate well characteristics directly from the standard back-pressure equation. Computers may then be utilized to save time and supply unique accurate values of data normally obtained by tedious graphical approximation. A. E. R.

1987. What is your lease worth? U. R. Laves. *World Oil*, 1958, **146** (4), 61.—Methods of reservoir evaluation are outlined, and the importance of evaluation early in the life of the field is emphasized. Oil reserves can be estimated by several methods: (1) volumetric determinations in which pore vol is calc and a recovery factor assumed; (2) extrapolation of various curves; (3) by comparison with an older, apparently similar property; and (4) by material balance. The monetary value of the estimated reserves can then be determined; this will be required for various purposes, *e.g.* a bank loan. Preparation of valuation reports in connexion with loans is noted, and it is emphasized that, because of inaccuracies in the basic data, all valuations can be considered only as estimates based on current information. C. A. F.

1988. Tests revealing new data on perforating. G. M. Wilson. *World Oil*, 1958, **146** (4), 128.—Recent tests of the efficacy of bullets or shaped charges in perforating will provide a more accurate means of determining the best type of perforation for the given well condition. In the tests, a sandstone core containing hydrocarbons and interstitial water under elevated temp and pressures, simulating well conditions, was measured for permeability. The specimen was then "shot" in a horizontal position and the permeability again measured under "well conditions." The ratio of the permeability before and after perforating is the "Well Flow Index" and is a measure of the success of the test. Evidence from the test results shows that there is a need for more research into the shape and size of bullets and shaped charges and the type of propellants or explosives used. C. A. F.

1989. New slide rule simplifies electric log quantitative analysis. R. G. Hamilton. *World Oil*, 1958, **146** (4), 81.—A description is given of a new slide rule designed for the rapid quantitative analysis of electric logs. It uses data from the S.P., resistivity, and micro curves, together with data from the induction log and radioactivity log, and is designed to replace the nomograms which are commonly used in quantitative logging. Diagrams show the front and back faces of the slide rule, and details of the calc which can be made are given, with examples. Calc are based on the standard electric log formulæ, and the most recent concepts in quantitative analysis are incorporated in the scales. C. A. F.

1990. Sound waves remove oil from sands in Alberta. Anon. *World Oil*, 1958, **146** (2), 104.—Experiments are being carried out to test a new technique for separating bitumen from the Athabaska tar sands of Canada. The method uses high frequency sound waves; these are shot out through loudspeakers immersed in the sand, and it is claimed that this reduces particle size with complete separation of oil, sand, and other liq. Another company is separating the sands using the Coulson centrifugal process. C. A. F.

1991. Nomograph speeds decline curve analysis. R. Harrell. *Petrol. Engr*, 1958, **30** (1), B36–7.—A simplified accurate method determines the reserves remaining in an oilfield through the use of semi-log decline curves to determine the economical production period, and a nomograph to evaluate the reserves. A. E. R.

1992. New methods show promise of increasing oil recovery. C. D. Russell. *World Oil*, 1958, **146** (4), 130.—Solvent extraction and miscible fluid displacement are promising methods for increasing oil recovery. In recent years much research has been carried out on the use of propane or LPG to flush oil from the reservoir rock. As it is uneconomical to inject a given vol LPG to produce an equivalent vol of oil, 2 production methods have been suggested: (1) the gas-driven solvent bank process, and (2) enriched gas injection. In the first a small bank of LP is injected and driven through the reservoir to the producing well by gas. Lab models of this method have been successful, and excellent recoveries were obtained; results of field tests are briefly described. In the enriched or wet gas injection method, large amounts of LPG are added directly to the gas stream and this mixture is injected. The LPG in the gas condenses and dissolves in the crude oil; this reduces the visc of the oil, which expands, and an oil bank rich in LPG is built up in front of the gas front. C. A. F.

1993. Venezuela: more oil, less demand. Anon. *Petrol. Press Serv.*, 1958, **25**, 124–8.—Interest induced by growing costliness and comparatively small exploration rewards in the U.S.A. has led *ca* 50 concerns to take a stake in oil exploration in Venezuela. Total drilling last year—boosted by the Suez emergency and granting of new concessions—increased by $\frac{1}{3}$ over 1956, and comprised *ca* 1750 exploration and development wells. Venezuela is already by far the world's largest oil exporter, with many fields well established and continuing exploration—especially on Lake Maracaibo and adjacent areas to NE. and W.—and construction of new facilities, pipelines, etc., continue to add to crude and refining capacity, to cope with future needs. At present *ca* 60% of Venezuelan production consists of heavy crudes. However, nearly all new

finds in Lake Maracaibo are light, low-S crudes. Future outlets of Venezuelan oil lie essentially in the W. Hemisphere, with the U.S.A. as the chief buyer. However, the pattern in Venezuela is affected by the present economic recession, also by import restrictions in N. America. Any further deepening of the U.S. recession will be reflected in lower Venezuelan production. Much is being done by the oil companies to conserve or put to use the large vol of natural gas produced in company with oil, including the building of long-distance natural gas pipelines. Increase in refinery capacity has followed a sharp post-war expansion of crude oil production. R. T.

OILFIELD DEVELOPMENT

1994. 1957 world crude output below par. Anon. *World Petrol.*, 1958, **29** (1), 32.—World oil production in 1957 increased by 6·8% over the previous year, compared with the 1956 increase of 7·2%. The decline in the rate of increase is due to a decline in consumption, both in Europe and the U.S.A. and to the Suez crisis. A table gives world production for 1957 and 1956 by areas and countries. This shows that the U.S.A. is now producing only 40·4% of the world's total, continuing a downward trend. Venezuelan production has continued to increase relatively and absolutely. Russia has shown a notable increase in percentage of the world's total production, from 9·5 to 13·2% in 1957. A second table shows the percentage distribution of oil production by principal areas and counties for 1957, 1956, and 1955. C. A. F.

1995. World exploration hits peak. Anon. *World Petrol.*, 1958, **29** (3), 38.—There was further expansion of activity in worldwide exploration during 1957, and this trend will probably be maintained during 1958. Outstanding discoveries were made in 1957 in Venezuela, Alaska, and Saudi Arabia. World discoveries and developments are briefly noted, being listed under countries. C. A. F.

1996. Drilling and exploration company of Dallas acquires six Bolivian concessions. Anon. *World Oil*, 1958, **146** (2), 104.—6 concessions covering a total area of some 500,000 hectares have been granted recently in Bolivia. These are in the E. part of the state, where oil conditions are considered favourable. Extensive surveys have been carried out over this area by several organizations, and over 100 structures have been mapped. 33 of these have been tested, resulting in the discovery of 11 oilfields. 4 of these are being actively operated by the Government Agency, Y.P.F.B., producing *ca* 10,000 b.d. Production is restricted by local demand and limited exports to neighbouring countries. C. A. F.

1997. Bolivian crude oil output up about 11·3% in 1957. Anon. *World Oil*, 1958, **146** (2), 106.—Oil production in Bolivia in 1957 is estimated at a minimum of 3,557,682 brl, 11·3% higher than in 1956. A moderate increase in production and drilling is expected during 1958 because of limiting pipelines. If additional lines are completed in Oct. 1958, as planned, production could be increased by 40%. A table shows production in Bolivia in 1957, by months. C. A. F.

1998. New concessions spark offshore oil search in Persian Gulf. Anon. *World Petrol.*, 1958, **29** (2), 31.—There will be increased offshore activity in the Persian Gulf during 1958 following recent concessions granted to Italian and Japanese companies, and further offshore drilling by other concerns. Much of the W. and S. marine areas of the Gulf are now committed, and a map shows how the concessions are distributed. The area is important because of its proximity to major fields and the great extent of the relatively shallow continental shelf. Most of the S. and W. parts are sufficiently shallow for drilling with modern techniques; to date one offshore field is being produced, and a recent well, Manifa 1, 8 miles offshore from Safaniya, has found gas and oil. The offshore field at Safaniya is producing over 100,000 b.d. from an anticline and is being developed. A new mobile drilling platform will be used for this purpose. Details of this are given. C. A. F.

1999. Oil leases in interior of Sarawak surrendered. Anon. *World Oil*, 1958, **146** (2), 100.—Some 36,650 sq. miles of leases in Sarawak have been surrendered. These are mainly in the interior, and have been intensively surveyed both before and since the war with no success. 17 deep tests were drilled, and all were dry, excepting those at Suai, where traces of oil occurred.

Exploration is continuing in the coastal region, and 10,850 sq. miles of concessions are being retained. Offshore exploration has been carried out off Sarawak, Brunei, and N. Borneo, and 2 offshore wells have already been drilled from a platform at Siwa *ca* 8 miles offshore, and one well has been drilled at Ampa Patches *ca* 25 miles offshore. All are in Sarawak waters and were dry. C. A. F.

2000. Oil crisis in Papua. L. Owen. *Bull.* (*Sydney*), 7.5.58, **79** (4082), 21–2.—Serious oil search in Papua dates from 1919 when the British and Australian Governments provided £50,000 each and the Anglo-Persian Oil Co. supplied and directed technical staff. The British Government withdrew in 1921 and the Australian in 1927, the A.P. Co. suspending operations in 1929.

Australasian Petroleum commenced a systematic survey in 1938 and completed its Kariava well at 12,621 ft without finding oil of commercial value. A 10,642-ft well at Hohoro completed in 1952 encountered no formations suitable as oil reservoirs.

Interest then moved westward, and wells were drilled at Omati, Aramia, Kuru, Barikewa, Morehead, Komewu, Sireru, and Puri. The current programme comprises completion of the Barikewa and Puri wells and of a third well at Kuru, all located near a line running W.–E. slightly below lat 7° S. and extending from W. of long 144° E. to long 145° E. Drillings have shown a zone or zones of porous and permeable beds with high-pressure " wet " gas underlying this line. The presence of oil is also probable.

From an original permit area of 9944 sq. miles an area of *ca* 1000 sq. miles has been culled and, within that limited area, there are prospects of commercial success. G. S.

2001. China's oil progress. G. G. Rosu. *World Petrol.*, 1958, **29** (2), 47.—Recent discoveries in NW. China have appreciably increased the reserves of the country, and it is estimated that total probable reserves are *ca* 20 billion brl, compared to 50–60 million brl proven in 1950. Production is, however, low, and in 1957 output was only 30,000 b.d., meeting *ca* ½ of China's rationed consumption.

Limiting factors have been shortage of investment funds and drilling and other equipment. Prominent discoveries during the first 5-year plan (1953–57) are reviewed; all activity has been concentrated in the NW. provinces of Shensi, Kansu, Tsinghai, and in the Sinkiang–Uighur region. Secondary recovery is being applied in a few fields. Geological organization in the country is discussed; since the formation of the Ministry of Geology in 1952 there has been rapid expansion of mass training facilities, but the quality of graduates is low.

Processing plant capacity is increasing, and a number of refineries are operating; these are listed. C. A. F.

2002. Sahara oil begins moving to market by pipeline. G. Halsell. *World Oil*, 1958, **146** (2), 97.—Constructional work is continuing on pipelines to connect the Sahara fields to

Mediterranean ports, and a 10-inch line from Hassi Messaoud to the Touggourt railhead has recently been completed. This is some 130 miles long, and the railway connects with Philippeville, 350 miles to the N. on the coast. Planned lines include a 600-mile, 20-inch line also from Hassi Messaoud to the port of Bougie; estimated cost is *ca* $100 million.

Estimated capacity of this field is 300 million tons/year, approx 15 times the annual petrol consumption in France. Pay depth is *ca* 12,000 ft, and the oil is light and sweet.

A line is also to be built from the Edjele field to a Mediterranean port. This field has a probable reserve estimated at 700 million brl. C. A. F.

2003. German exploration active. A. M. Stahmer. *World Petrol.*, 1958, **29** (3), 50.—Oil production in W. Germany increased by *ca* 8000 b.d. during 1957, the total for 1957 being approx 28 million brl, compared with 25 million brl in 1956. Most of the increase in production was from fields in the Hanover and Weser–Ems areas. Proved reserves at the beginning of 1957 were estimated at 265 million brl, and these increased by 15 million brl during the year.

There was expansion of exploratory activity during the year, with a tendency for deeper drilling to explore the Zechstein and the beds beneath the salt in NW. Germany. Details of important finds are given, and maps show the locations of new discoveries. C. A. F.

2004. Austrian oil decision. G. G. Rosu. *World Petrol.*, 1958, **29** (1), 40.—The Austrian oil industry operates under rigid state control, and production from the fields is declining; but current discussions may change the arrangements for oil administration in the country. Oil development is outlined, the outstanding field being Matzen, which produces *ca* 70% of the total output. It was found in 1949, and by the end of 1955 output per well had reached 166 b.d., with the productive area covering some 1800 acres. Pay is the Matzen sand group at *ca* 5500 ft, which contains 16 individual sands. Porosity is 28%. There are 458 producing wells, approx 60% of which are flowing. Beneath the Matzen the Helvetian is also oil-bearing, and this is under development.

The fields of Austria are situated in the Vienna basin; additional reserves will require intensive exploration over a considerable area. C. A. F.

2005. Ragusa field success stimulates oil search in Sicily. Anon. *World Petrol.*, 1958, **29** (1), 37.—The Ragusa field in SE. Sicily was discovered in 1954, and since then leasing and exploration has extended throughout the island. One further field has been found, and two wells have had encouraging shows. All are near Ragusa with oil in Trias dolomite. Present output is *ca* 35,000 b.d.

27 wells had been completed at Ragusa in Sept. 1957, and during 1958 some 15 or more development wells will be drilled. The structure is a dome with a small gas cap, but water is the main drive. The oil and gas column at the crest is *ca* 1500 ft. The oil is 19·5–19·7 gravity, and is sweet, with high visc at low temp. Depth to the pay is *ca* 6000 ft, and wells are being pumped. A recently-completed pipeline transports the oil to a refinery at Augusta.

Exploration on the island is difficult because of complicated geology, but there are many surface indications of oil. On the S. coast oil has been found at Gela, the discovery well producing *ca* 1200 b.d. of heavy oil from dolomite. Additional wells are being drilled. At Rosolini, E. of Ragusa, a well is reported to have a potential of 1200–1500 b.d. of 15° oil, and is thought to be on the flank of an important structure.

Since the end of the war 33 wildcats have been drilled in Sicily, and the island is producing *ca* $\frac{1}{5}$ of Italy's domestic requirements. C. A. F.

2006. Recent petroleum activities in Spain. J. M. Rios. *World Petrol.*, 1958, **29** (3), 53.—Recent exploratory activities of 3 companies operating in Spain are described. 2 wells in N. Spain, Leva 1 and Leva 2, have been drilled on an anticline, and there were indications of light oil in the Albian in the first well. Geological and geophysical work have been carried out on a large scale in most promising areas of the country, and gas has been found in a few wells. The geological sections penetrated by recent wildcats are given in outline. A map shows the location of the tests. C. A. F.

2007. Offshore oil is object of drilling in Bulgaria. Anon. *World Oil*, 1958, **146** (2), 106.—Further testing of the major Bulgarian field, Tuljanova on the Black Sea coast, has shown by geophysics that there is offshore extension. A directional well is being drilled, and others are planned. Projected production in Bulgaria for 1958 is *ca* 2·1 million brl. C. A. F.

TRANSPORT AND STORAGE

2008. Application, installation, and maintenance of automatic tank gauges. G. D. Robinson, Jr. *Pipe Line News*, 1958, **30** (4), 41–8.—After briefly reviewing the background of tank gauging, the types of gauge in general use at present are discussed. The advantages and drawbacks of the various types are indicated, and then the installation and maintenance of specific types of gauge are dealt with in some detail. Comprehensive diagrams are given of the installations described. D. K. R.

2009. Modern cleaning methods for tankage equipment. L. S. van Delinder. *Corrosion*, 1957, **13** (6), 359–60t.—The cleaning of tankage holding water soluble light liq, viscous water soluble materials, and solids is usually effected by hot water washing, while light oils are removed by steaming. Heavy oils and greases, and materials having a residual odour when removed, present a harder problem. Lab testing is desirable due to the time and expense of field testing. Simulation of conditions for steaming and hot water washing is described. 0·1% of a non-ionic wetting agent in hot water (140° F) was found to be very successful for removing oils and greases from clean and rusty steel, aluminium, and phenolic coated surfaces, and compared favourably with commercial cleaning cpds. Tests carried out on tank cars confirmed lab results. Wetting agents have to be selected with care, as many have inverse solubility in hot water. Some commercial cleaning cpds were found to be unsatisfactory for aluminium, and all those used were too aggressive for baked phenolic coatings. Steaming was found to be the only satisfactory way to remove residual odours from some organic liq. F. M. G.

2010. Simplified gamma-ray technique used in LPG storage well logging. R. F. Sippel and H. D. Hodges. *Petrol. Engr*, 1958, **30** (4), B118–23.—A simple, inexpensive logging tool locates the LPG–salt water interface in underground salt dome storage wells accurately. The cross-sectional area of an underground well may be measured as a function of depth by metering the input fluid. A. E. R.

2011. Sonar caliper simplifies LPG storage surveys. J. P. Chisholm and G. D. Patterson. *Petrol. Engr*, 1958, **30** (1), B90–2.—A recently developed sonar caliper measures the time required for directional sound-impulse beams to travel from a down-hole transmitter to the cavern wall at various

depths, so that from the cross-sections surveyed the vol of underground caverns used for LPG storage may be calculated. Fluid samples are required at various depths to determine the speed of sound at each depth. Signals are received on a cathode-ray tube and are photographed. A. E. R.

2012. The corrosion resistance of ductile iron in sea water and petroleum tanker services. M. Paris and B. de la Brunière. *Corrosion*, 1957, **13** (5), 292–6t.—The corrosion resistance of ductile cast iron pipe has been compared with that of steel pipe and sheet, and grey cast iron pipe, both in the lab and in tanker service since 1950. Sea water and chemical lab tests indicated that ductile cast iron had similar corrosion rates to grey cast iron. Lab tests simulating conditions in crude oil tankers suggested that ductile cast iron containing 1·5% Ni would be suitable, and this has been confirmed in practice, where this material has been found to be most satisfactory for filling and discharge lines and heating coils, in tankers carrying sour crude oil. F. M. G.

2013. Mineral oil storage without evaporation losses. (In German.) G. C. Kindermann and A. Luthe. *Erdöl u. Kohle*, 1957, **10**, 382–5.—Storage of mineral oils and mineral oil products is considered in relation to vaporization losses, hazards, etc. Tanks with fixed and floating roofs are compared. Edge sealing methods for floating roofs are illustrated and discussed. R. T.

2014. Refrigerated propane tankers to be built in Italy. A. M. Stahmer. *World Petrol.*, 1958, **29** (1), 33.—Oil and LPG tankers are to be built in Italy, and it is expected that work on the first will begin in March 1958, with completion in mid-1959. The capacity of the shipyard (at Livorno) will be 6 ships annually, with a total tonnage of *ca* 250,000–300,000 tons. Plates will be welded in prefabrication workshops and then joined on the building site.

2 types of ship will be built: normal oil tankers of 40,000 dwt up to 100,000 dwt, and propane gas tankers. For carrying LPG from the Persian Gulf to Europe a tanker has been designed which can carry refrigerated propane under normal pressure. It will carry 6 midship twin tanks, with a capacity together of approx 4000 tons, accommodating a total of *ca* 25,000 tons of liq propane at −45° C. It will have 16,000-h.p. turbines and a cruising speed of 17 knots. C. A. F.

2015. What is economic pipe size? C. J. Shelton, Jr. *Petrol. Engr*, 1958, **30** (4), D19–25.—A rapid method is given for estimating the economic dia of a pipeline allowing for pipeline and pumping station investment and operating cost. A. E. R.

2016. Large pipeline projects. A. C. Hartley. *Fluid Handl.*, 1958, 201–4.—Summary of latter part of lecture given to Inst. Mech. Engrs. Economics of large pipelines are considered relative to other forms of oil transport. Manned pumping stations in remote areas can be expensive due to necessity to provide ancillary services. In the case of Tapline this difficulty was overcome by using unmanned automatic pumping stations mounted on vans so that portions could be towed away to a depot for maintenance and repair, similar transportable spares being available at the depot. For product lines, in order to avoid mixing of successive batches, turbulent flow is essential, hence dia are smaller than for crude lines. Problems encountered with heavy fuel oil and gas lines, and methods of communication, are briefly considered. Finally, recent developments in tanker loading are described. Flexible hoses may be replaced by steel pipes and mechanical joints for pier loading. For sea loading, hoses must be made extra heavy to withstand damage on the sea bed, and handling difficulties impose a size limitation. In an effort to overcome this, trials are taking place of a steel pipe which can be made buoyant by pumping water out of an attached container, only short lengths of flexible hose being necessary as connectors. W. A. M.

2017. Asphalt type protective coatings for underground pipelines—wrapped systems. NACE Technical Unit Cttee T–2H. *Corrosion*, 1957, **13** (4), 283–5t.—Tentative recommendations on specifications have been made by NACE Technical Unit Cttee T–2H on asphalt type pipe coatings in this first interim report. These cover description of types of wrappings, materials, construction, and cathodic protection, and an appendix gives methods of test for: (1) settlement of mineral filler in filled asphalt pipe enamels; (2) resistance of asphalt pipeline coatings to flow under soil stress; and (3) determining the electrical resistance of asphalt pipeline coating. F. M. G.

2018. Asphalt type protective coatings for underground pipelines—mastic systems. NACE Technical Unit Cttee T–2H. *Corrosion*, 1957, **13** (5), 347–50t.—This second interim report by NACE Technical Unit Cttee T–2H on asphalt type pipe coatings gives tentative recommended specifications on mastic systems. These cover description of system, materials, construction, cathodic protection, and maintenance, with an appendix on testing of asphalt primer and mastic pipeline coatings. F. M. G.

2019. Auxiliary drives and power sources for gas turbine stations. J. R. Hoffman. *Pipe Line News*, 1958, **30** (5), 45–7.—Some of the major considerations which must be taken account of during the selection of aux drives and power sources for gas turbine-driven natural gas pumping stations are discussed. It is stated that for all functions excepting the starting of the turbine itself, electric motors are very efficient. The 3 usual sources of electrical supply, *i.e.* purchase power, engine-driven generators, and gas turbine-driven generators, are compared. The choice of starting device for the turbine generally lies between: (1) an electric motor, (2) an i.c. engine, and (3) an expansion gas turbine. Factors which may govern the choice between these 3 are suggested. D. K. R.

2020. Earth anchors prevent pipe flotation at crossings. W. L. Hollander. *Oil Gas J.*, 26.5.58, **56** (21), 98.—A screw-type earth anchor is used by several companies as an inexpensive counterweight against pipelines floating at river crossings and in swamps. Computations are given to determine the basis for anchoring a 24-inch pipeline under average pipeline-anchoring conditions. G. A. C.

2021. Noise abatement in gas pipeline operations. S. Lascoe. *Pipe Line News*, 1958, **30** (5), 24–32.—The general problem of noise in a community is discussed. The engineering aspects of tackling the problem are mentioned, and then the special cases of problems present in the gas pipeline industry are considered. The noise produced by each section of plant is analysed, corrective measures already used are described, and suggestions made for further improvement. D. K. R.

2022. Products pipeline failure under cathodic protection. W. H. Bruckner. *Pipe Line News*, 1958, **30** (3), 45–7.—It is pointed out that the voltage required to give cathodic protection to steel pipe buried underground is not a standard value, but varies with the environment. Further, while 100% corrosion control may be desirable, due to the heterogeneous nature of much pipe, it is often the case that large surface areas are overprotected to an extent which is economically unsatisfactory. An example is cited of a 6¼-inch o.d. pipe which was laid with cathodic protection of −0·85 V and *ca* 20 years later suffered longitudinal failure along the butt weld. The case is critically examined, but it is mentioned

that a similar pipeline without protection lasted only 2 years before failure. D. K. R.

2023. First ethylene pipeline built for interstate shipments. Anon. *Petrol. Engr*, 1958, **30** (2), D42–4.—The construction of the first interstate pipeline in the U.S.A. to transport high purity ethylene is described. The pipeline is 30 miles long of 6⅝-inch o.d. pipe operating at 1000 p.s.i.g., but withdrawal pressure will be at 450 p.s.i.g., so that the pipeline may be used as a storage facility. Some of the line passes through marshy country, and the pipe was carefully weighted to prevent floating or excessive sinking in the ooze. The line was coated with enamel and wrapped with glass fibre and asphalt, followed by heavy kraft paper. At withdrawal points steam heaters were installed to avoid liquefaction due to pressure reduction, which is accomplished in 2 stages to obtain more accurate control at the metering point. A. E. R.

2024. Remarkable fuel-carrier. Anon. *Gas Oil Pwr*, 1958, **53**, 123.—The fuel is contained in tyre-shaped containers, each 5 ft high and 3½ ft wide, holding 500 gal, which are arranged in pairs on axles and fitted with filling, emptying, and brake systems. A towing beam connects the axles, which are usually 5 in number.

The tyres can be used with most types of fuel between −80° and 160° F. The speed of transportation depends on the terrain; with an 8-ton load speeds up to 25 m.p.h. can be attained. The towing vehicle is powered by a 250-b.h.p. 8-cyl opposed-bank air-cooled Continental engine. H. C. E.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

2025. Selection of furnace tubes. Pt 1. T. M. Krebs. *Petrol. Engr*, 1958, **30** (2), C54–8.—Factors governing the selection of furnace tubes for refinery and petrochemical service are discussed. Strength, corrosion resistance, and structural stability of tubing are metallurgical features; stress, temp, time, and chemical nature are factors varying with the application; economic factors include tube cost and fabrication and maintenance costs. A. E. R.

2026. Complete automation of a process plant. I. C. Bechtold. *Oil Gas J.*, 9.6.58, **56** (23), 115.—The ideal situation for computer control is at feedback loop of the control system, where it receives same information at receiver by recorder-controllers, and thus cost calculations can be made. Types of computer, instrumentation, data logging, and economics are discussed. G. A. C.

2027. How Sohio designed and justified a pin-up. D. O. Maxwell. *Petrol. Engr*, 1958, **30** (1), C16–22.—Detailed economic studies are described which led to the replacement of outmoded refining units with a new integrated refinery, which shows substantial capital and operating cost savings compared with the conventional refinery, due to the streamlining of process operations. A. E. R.

2028. No smoke, no light, no noise. P. D. Miller, H. J. Hibshman, and J. R. Connell. *Oil Gas J.*, 19.5.58, **56** (20), 137.—A new multi-jet flare developed by Esso is described which requires no aux utilities such as steam or water in its completely smokeless and noiseless burning. A table shows typical flare costs. G. A. C.

2029. Thirteenth Annual Unit Operations Review. Various. *Industr. Engng Chem.*, 1958, **50** (2), 3.—*Evaporation.* Better understanding of pressure drops found in mixed vapour–liq flow and new methods for the evaluation of the liq–vapour ratio, including the use of radioactive tracers, allow more accurate predictions of boiling film coeff.

Flow of Fluids. Work is reported on the mechanical design of flow systems, with solutions of the stress analysis of multiplane piping systems, studies of fatigue, and consideration of piping material for rigorous service.

High Temperature Distillation. With the general availability of computers empirical correlation has given way to rigorous calculation, dispensing with the simplifying assumptions previously necessary.

Liquid Extraction. Research now tends to be directed towards developing an understanding of the mechanisms of extraction. Work on equilibria and methods of calculation and a table of new petroleum processes are given.

Also reviewed: absorption and humidification; adsorption; centrifugation; crystallization; drying, flotation; ion exchange; materials handling; mixing; size reduction. D. K. R.

2030. The gas oil desulphurization units at the Isle of Grain refinery. G. M. Rowell and F. L. Lempert. *Petroleum, Lond.*, 1958, **21** (4), 116–18.—At the Kent refinery a gas oil cat desulphurization process suitable for a variety of feedstocks was selected. The cat contains oxides of cobalt and molybdenum. Twin reactors each have a charge of 10,000 b.d. of gas oils. The units were designed for low hydrogen and utilities consumption, ease of control and operation, and prevention of overheating to avoid decomposition of the gas oil. H_2S from the process is converted to sulphur. Regeneration of the cat is accomplished by controlled combustion using steam and air at 750°–1000° F. A. E. R.

2031. Sulphur production and acid recovery units. Anon. *Petroleum, Lond.*, 1958, **21** (5), 151–3.—New units at the Isle of Grain refinery are described in detail with flow diagrams. The sulphur recovery unit converts hydrogen sulphide into sulphur by the Claus process. A direct spray burning process is used in the acid recovery unit to decompose sludge acid and to regenerate it as 98% pure sulphuric acid for re-use. A. E. R.

2032. Waste disposal at Anacortes. E. D. Newmann, C. J. Reid, and L. C. Burroughs. *Oil Gas J.*, 19.5.58, **56** (20), 124.—A description is given of Shell Oil Co.'s efforts at Puget Sound in waste treatment to avoid any contamination which would result in danger to wild life in the surrounding fishing paradise. The plant has successfully reduced phenols below the 0·2 p.p.m. legal limits. Tables show effects of temp, heavy sulphide, and phenol loading on biotreatment used. G. A. C.

2033. Optimum non-linear gasoline blending on IBM 650 computer. F. R. Dornheim and B. T. Borgenon. *Oil Gas J.*, 26.5.58, **56** (2), 91.—A programme for calculating a tangential approximation to the blending octanes of the components of a particular blend has been developed for the IBM 650 computer, and the blending values used to apply linear programming. G. A. C.

2034. Aluminium in the oil industry. I. S. Black. *Petrol. Times*, 6.6.58, **62** (1587), 463.—Properties of aluminium and alloys at low and high temp are discussed, together with processes for welding and resistance to corrosive attack. G. A. C.

CRACKING

2035. Reforming studies with molybdena–alumina catalyst. J. L. Wilson and M. J. Den Herder. *Industr. Engng Chem.*, 1958, **50** (3), 305–8.—When powdered molybdena–alumina cat were used commercially, the need for process-variable data on this type of cat and quick methods of testing and accurately evaluating it arose. Studies of the powdered cat in pilot fluid-bed plant or pelleted cat in fixed-bed units are costly and slow. A new approach is described whereby a reference naphtha is processed in a bench scale fixed-bed unit with the cat, and the effects of temp, space velocity and hydrogen-addition rate on O.N. and coke production are ascertained. This data was used to produce an activity scale, a reference yield–octane relationship, and a reference coke-production curve. From these 3 the cat quality is rated relative to a reference cat. Details are given of the cat and equipment used and the experimental procedure employed. Process data are presented and discussed in a process variable study and an assessment of cat quality. The derivation of the mathematical activity scale is given. Suggestions for the application of such process data are made. D. K. R.

2036. Thermal catalytic cracking of isomeric dodecanes and hexadecanes. (In German.) E. Terres and G. Groppenbacher. *Erdöl u. Kohle*, 1957, **10**, 281–5, 356–61.—Pt 1. Introduction—initial material preparation—testing apparatus and procedure. Pt 2. Test results—comparison between pure thermal and thermal cat cracking.—Pt 1. Possibility and extent of the effect of isomerization of straight-chain hydrocarbons on yield and nature of cracked products in cat-thermal cracking are investigated. The influence of No. and arrangement of methyl side members is studied on 2 isomeric series of synthetic paraffins containing 12 and 16 C atoms. Pure thermal-reaction over free radicals—and thermal-cat cracking-reaction over carbenium ions—are compared to evaluate the results of thermal-cat cracking. Max cat activity—related to its acidity—is important. Comparable results were obtained by thermal-cat cracking of dodecanes and hexadecanes at 495°–505° C over Cr-bead cat. Gaseous hydrocarbons were quant separated into material groups by the Henjes process. Liq products were separated by fine fractionation. Wt, *n*, and iodine No. were determined for each group. The i.r. and u.v. spectra of the liq fractions of the hexadecanes show that, proportionately, many olefins and *iso*-cpds, and —down from C_7 fractions—aromatics occur. Heats of cracking were calc from the difference between measured heats of combustion of the original materials and calc val of the final products. For dodecanes heats of cracking are *ca* 47–53 kcal/mol, for hexadecanes 37–43 kcal/mol. The heats of cracking lie *ca* 20 kcal/mol higher for the highest branched mol.

Pt 2. In thermal-cat cracking of isomeric dodecanes and hexadecanes, products of 3–6 C atoms are formed especially, whilst the portions of C_2 and C_1 and higher than C_6 always remain lower. Comparison of cracking results for individual isomeric dodecanes and hexadecanes shows the influence of chem constitution in some important points. Cracking processes are the same throughout. However, cracking amount changes considerably, rising in the dodecanes from 21·3% in *n*-dodecane to 38·5% in 2-methylundecane, and in the hexadecanes from 44·8% in the *n*-hexadecane to 53·8% in 2-methylpentadecane. The remaining isomers keep approx to the val of 2-methyl cpds, only the most branched mol fall below the straight-chain val. *Iso*-paraffinic initial substances give a higher cracked product yield with a max in presence of a methyl side chain. Increase in the CH_4 cont of the cracked product indicates the influence of the methyl side chain with increased branching. With the branching degree the C_4-portion increases at the expense of the C_3- and C_5-portions. Further, a mol is easier to crack with increasing length of its C-chain. R. T.

2037. Cracking gases. Production and composition. J. N. Moreno. *Combustibles (Zaragoza)*, 1957, **17**, 309–21. Review; 14 composition tables, 5 flow sheets, 37 refs. A. C.

HYDROGENATION

2038. How hydrogenation improves cat cracker feed. M. D. Abbott, R. C. Archibald, and R. W. Dorn. *Oil Gas J.*, 19.5.58, **56** (20), 144.—Lab and pilot-plant cat cracking of a variety of hydrogenated feed stocks show that hydrogenation reduces coke yields 65% and increases gasoline produced by 20%. At the same time under suitable conditions sulphur and nitrogen contents of the oil converts a large proportion of condensed polyaromatic to monoaromatic cpds. G. A. C.

POLYMERIZATION

2039. Polymerization of ethylene on metal cæsium and rubidium. G. Lemetre, V. Martello, and G. Nobile-Orazio. *Chimica e l'Industria*, 1958, **40** (6), 270–5.—Several semi-commercial tests of ethylene polymerization on metal cæsium according to the Clusius and Mollet method were conducted.

The possibility of using carriers for the alkaline metal other than steel wool used by Clusius was examined; sintered reduced copper and aluminium wool were found excellent. Like cæsium, rubidium diffused on steel wool ôffects ethylene polymerization; with rubidium it is necessary to work at much higher temp (135°–140° C) than with cæsium (60°–80° C).

The main fraction of the polymerized products (b.p. 110°–110·5° C) is formed by 3-methyl-3-ethylpentene (1) and small amounts of 5-methylheptene (1).

All the tests carried out have shown the impossibility of obtaining polymers higher than C_{14}; the authors' conclusion is that excessive branching of polymerization products tends to arrest the reaction. (Authors' abstract.)

CHEMICAL AND PHYSICAL REFINING

2040. The application of gas/liquid cyclones in oil refining. J. R. J. van Dongen and A. J. Ter Linden. *Trans. Amer. Soc. Mech. Engrs*, 1958, **80** (1), 245–51.—A discussion of the importance of separators in the oil industry is followed by a description of experiments carried out on pilot plant to determine the optimum design of cyclone. The application of cyclones to separations arising from heating, flashing, and cracking operations is described. 2 pages of discussion, 2 refs. C. B.

SPECIAL PROCESSES

2041. Results on probable basic reactions in the Fischer–Tropsch synthesis from exchange balances. (In German.) E. Weingaertner, P. K. Deshpande, and M. Ramacharyulu. *Erdöl u. Kohle*, 1957, **10**, 366–71.—H_2 for primary olefin hydrogenation is obtained from various sources. With Fe cat the H_2 is activated as a result of reduction reaction displacement in favour of the *b*-reaction. Displacement can occur with Co- and Ru-cat at high temp, generally originating under definite conditions. In the majority of cases the hydrogenation H_2 with these cat originates from an immediate activation. Individual reactions are shown by a series of balances to be distributed according to integral relations on the summation reaction. Typical syntheses are balanced. Occurrence of a negative hydrogenation H_2 val in sp cases is

discussed, and is attributed to consumption of CO above the reduction reaction requirement. Study of conditions for Co and Fe cat shows that reactions consuming additional CO are intermediate reactions, which yield unnoteworthy products under normal synthesis conditions and are not noticeable immediately, but appear under extreme conditions. Such reactions are OXO synthesis, aldehyde reduction, direct CH_3·OH formation, carbonyl formation, and C separation. An expanded reaction scheme is developed which includes the intermediate reactions, and permits calculation of formation of these products. Calculation examples are shown and discussed with the aid of synthesis results. Carbonyl is detected qualitatively in the exit gases. R. T.

2042. Permeation: a new way to separate mixtures. R. C. Binning and F. E. James. *Oil Gas J.*, 26.5.58, **56** (21), 104.—American Oil Co. has been developing a permeation technique for separation of liq mixtures by use of thin plastic films or membranes whereby solubility of material in the polymer comprising the membrane is utilized. The material moves through the polymer structure by an activated diffusion process and is finally removed in the vapour phase on the opposite side of the membrane. G. A. C.

METERING AND CONTROL

2043. Fuel flow test house. Anon. *Fluid Handl.*, 1958, 189–92.—Illustrated description of Firth Cleveland fluid flow test house at Treforest, comprising 4 × 3000 gal fuel storage tanks, flowmeter and instrument test rigs, equipment for testing water separators, filters, valves, etc., and a control room with remote controls (manual or automatic) for each test rig. For flowmeter and instrument testing flow rates up to 8000 g.p.h. and for testing of valves, separators, etc., rates up to 60,000 g.p.h. can be attained. Temp can be varied between −40° and +55° C and fresh or salt water can be injected at rates up to 6000 g.p.h.; solid contaminants can also be added continuously at pre-determined rates. W. A. M.

PRODUCTS

CHEMISTRY AND PHYSICS

2044. Rheology of petroleum products. R. N. J. Saal. *Chim. et. Industr. (Génie Chim.* suppl.), 1958, **79**, 1–11.—General survey of rheological aspects of petroleum production, transport, refining, and applications. Effects of shearing stress are considered in relation to elasticity, visc, crit flow pressure, and visco-elasticity. The following examples are discussed in general terms with the aid of graphs, appropriate formulæ are given; elasticity of bitumen in road mixes, visc and visc–temp characteristics of lub oils in hydrodynamic lubrication, crit flow pressures of waxy products and greases, and visco-elasticity of bitumen in relation to its rheological characteristics at high and low temp. In the final section various types of fluid flow are described, and it is shown that in certain cases density must be considered as well as rheological properties. W. A. M.

2045. Sixth Annual Fundamentals of Chemical Engineering Review. Various. *Industr. Engng Chem.*, 1958, **50** (2), 3.—*Heterogeneous Catalysts.* Much work is reported on kinetic studies in cat, and although some significant results have appeared, more data must be obtained before further theories of cat behaviour can be formed.

Computers, Mathematics, and Statistics. The widespread increase in the use of digital computers, both large and small, is noted. References are given to their use in connexion with problems on dist and pipeline networks.

Mass Transfer. Work on diffusive separation processes is reported, and in one study it was found that packing in annular thermal diffusion columns caused greatly increased separation for various liq mixtures.

Thermodynamics. Much data has been published this year on such topics as P–V–T relationships, vapour–liq equilibria, liq–liq equilibria, heats of reaction, and general thermodynamic properties.

Also reviewed: molecular transport properties of fluids; diffusion of metals; oxidn of metals; colloids and surface behaviour; process control and automation; fluid dynamics; heat transfer. D. K. R.

2046. Molecular sieves as subtractors in gas chromatographic analysis. N. Brenner and V. J. Coates. *Nature, Lond.*, 1958, **181**, 1401.—*n*-Paraffins are irreversibly adsorbed on synthetic zeolites of the mol sieve type, whereas other aliphatic and aromatic hydrocarbons are virtually unretarded. Thus by placing such a column in series with a partition column, the bands formed in the latter by *n*-paraffins can be readily identified, since they will be missing from the chromatogram of the gases after passage through both columns. Chromatograms of a reformed gasoline fraction are given as an example. H. C. E.

2047. Mass spectrometric observations of ions in hydrocarbon flames. P. F. Knewstubb and T. M. Sugden. *Nature, Lond.*, 1958, **181**, 1261.—An apparatus has been made which samples continuously the products of a flame buring at atm pressure, extracts the ions in a low-pressure chamber, and passes them to a mass spectrometer. Generally, the ions are those of hydrocarbon mol formed by rapid polymerization of the fuel. The extent of polymerization is greater for acetylene and ethylene than for methane and ethane. In lean flames the rate of decay is fast, but in rich flames the high mol. wt. components can be detected over much of the flame height.

In the flame of acetylene most of the ions have mass numbers around values corresponding to $C_nH_n^+$ where $3 \leqslant n \leqslant 10$, those of odd mass number predominating. Other peaks are thought to arise from ions containing oxygen. H. C. E.

2048. Applied hydrocarbon thermodynamics. Pt 3. Liquid and vapour densities. W. C. Edmister. *Petrol. Refin.*, 1958, **37** (3), 183–8.—A series of charts of specific vol (ft^3/lb) *v.* temp and pressure for the 8 hydrocarbons methane, ethane, propane, *n*-butane, *iso*butane, *n*-pentane, ethylene, and propylene is presented. The data, derived from actual experimental work on the hydrocarbons, are consistent and cover wide ranges of temp and pressure. Liq densities of light hydrocarbons in solutions are given, and a series of factors for conversion of flow in b.d. to lb/hr is presented. J. R. T.

2049. Modified equation predicts *P–V–T* behaviour for similar gases. S. R. Darin, E. B. Stuart, and J. Coull. *Oil Gas J.*, 16.6.58, **56** (24), 105.—The Benedict–Webb–Rubin equation has been modified so that it can be used for a group of similar gases. A compressibility chart using the reduced equation is given. G. A. C.

2050. Phase equilibria in binary and multicomponent systems. C. Black. *Industr. Engng Chem.*, 1958, **50** (3), 403–12.—A simplified method of predicting phase equilibria in multicomponent systems is presented. Empirically modified van

Laar type equations relating activity coeff and liq composition are derived, and the range of application of the equations is discussed. Phase equilibria in binary and multicomponent systems are considered separately, and questions such as the effect of pressure on vapour–liq equilibria, influence of pressure on azeotropic composition, and the significance of partial miscibility are dealt with. Examples of the application of the equations are given. D. K. R.

2051. Vapour phase imperfections in vapour–liquid equilibria. C. Black. *Industr. Engng Chem.*, 1958, **50** (3), 391–402.—A knowledge of deviations from the laws for perfect gases and ideal solutions is very valuable in the chemical and petroleum industries. Semi-empirical equations of state are developed for polar and non-polar substances, and tables of coeff for the various substances tested are given. The equations developed cover the region from zero to saturation pressure and for temp up to the critical value. Applications of the formulæ given are mentioned. D. K. R.

2052. Transformation of hydrocarbons in a high-tension electrical field and the analogy with radioactive radiation. M. Freund and G. Földiak. *Riv. Combust.*, 1958, **12** (4), 291–302.—The authors report tests made in processing hydrocarbons by means of high-tension (12 kV) electrical fields.

Gas stability (tending to develop gas) was studied both in vacuum and at normal pressure in various gas atm (air, oxygen, hydrogen, nitrogen, etc.), with liq paraffin, an insulating oil, *n*-cetane, and other pure hydrocarbons.

The behaviour of paraffin hydrocarbons when subjected to the electrical field and to radioactive radiation revealed a certain analogy. (Authors' abstract.)

2053. Electrostatic charging of hydrocarbons after oxygen action. (In German.) H. Luther and B. Hampel. *Erdöl u. Kohle*, 1957, **10**, 297–300.—Experiments with standard gasoline, a diesel power fuel cut, an olefin, and an alkyl aromatic show that electrostatic charging in a measured distance increases with the aging of the contained product. From the authors' earlier work it must be accepted that the electrostatic charging can decrease again on too strong aging as a result of too high conductivity. During the induction period substances—probably peroxides, ketones, and acids—are formed, undetected by former conventional methods, which change the electrostatic excitability of the hydrocarbons. In presence of metallic cat—especially present on formed metallic soaps—ionic primary reactions occur. As soon as their concn exceeds a threshold val, the autocat period, with its reaction chains, sets in. R. T.

2054. Effect of pressure on burning velocity of nitric oxide flames. G. A. McD. Cummings. *Nature, Lond.*, 1958, **181**, 1327.—The burning velocity (v) of the stoichiometric mixtures H_2/NO, CH_4/NO have been measured by the Bunsen burner method over the range 0·2–40 atm. The results indicate that v, independent of pressure in the range 1–40 atm, has the average value 58 cm/sec for H_2/NO and 39 cm/sec for CH_4/NO in this range. In both cases the flame temp rises markedly with pressure, whereas the concn of O, H, and OH vary only slightly with pressure. H. C. E.

ANALYSIS AND TESTING

2055. Photometric determination of carbonaceous matter in used oils from diesel engines. B. Bernelin. *Rev. Inst. franç. Pétrole*, 1958, **13**, 259–66.—Carbonaceous matter in used oils is usually determined by pptn with solvent, filtering or centrifuging, and washing with solvents. A quick photometric method is described in which the oil is diluted (5 g oil/1 l C_6H_6) and optical density of suspension determined at 500 mμ. System obeys Lambert's and Beer's laws, and readings remain const for at least 30 min. Method can be used to follow deterioriation of oil in use. Under road conditions allowance must be made for non-carbonaceous insolubles. W. A. M.

2056. Temperature compensation in viscometric measurements. (In German.) K. Kirschke and H. Umstätter. *Erdöl u. Kohle*, 1957, **10**, 375–7.—The necessity for a second, internal, thermometer in the Ubbelohde viscometer to check the true temp of the oil in each measurement is examined. This is found to be superfluous, because changes in apparatus const introduce a greater error than incomplete temp equalization, which can be avoided by adequate tempering duration. Numerous graphs are presented. R. T.

2057. Investigations on a German recycle oil. (In German.) W. Fuchs and G. Nettesheim. *Erdöl. u. Kohle*, 1957, **10**, 362–5.—A German recycle oil—analytical data presented—is decomp by urea-adduct pptn and adsorption chromatography in a multichromatographic column. The decomp by urea pptn yields a paraffinic and an *n*-paraffin-free portion. Chromatographic separation of the paraffins yields *iso*-paraffins, paraffins, and alkylnaphthenes, whereby pure *n*-paraffins docosane and tricosane are isolated. Decomp of the de-paraffined portion by chromatography on silica gel yields *iso*paraffins, alkylbenzenes, alkylnaphthalenes, and alkylphenanthrenes. Individual material classes are identified by their u.v. and i.r. spectra and other physical data, also by structural group analysis. An i.r. spectroscopic method determines the No. of methyl groups/mol from the intensity of the symmetrical methyl deformation oscillations at 1380 cm^{-1}. 18 refs. R. T.

2058. Modified method for the determination of polycyclic hydrocarbons. B. T. Commins. *Analyst*, 1958, **83**, 386–9.—Polycyclic hydrocarbons (anthracene, pyrene, fluoranthene, 1 : 2-benzanthracene, 1 : 2- and 3 : 4-benzopyrenes, and 1 : 12-benzoperylene) were determined in soot from smoke collected in and around diesel bus garages. Method used was extraction with *cyclo*hexane, concn of extract, and percolation through Al_2O_3 column using *cyclo*hexane as eluant. Successive fractions were examined spectrophotometrically at given wavelengths obtained from soln of the pure hydrocarbons. For each hydrocarbon peak ht above a narrow base line (approx ±3 mμ from peak wavelength) α amount present. In the case of fractions containing mixtures of 1 : 2-benzanthracene and fluoranthene, the peaks of which are close together, it is necessary to determine absorption at 4 wavelengths and solve equations to obtain composition. Results of repeated determinations indicate that single determinations would be within ±25% of mean val. W. A. M.

2059. Analysis of hydrocarbon mixtures. (In German.) G. Kühnhanss *et al.* *Erdöl u. Kohle*, 1957, **10**, 372–5.—Pt 1. Separation of a diesel oil fraction from the TTH-stripper and determination of the material content. For separating the material mixture diesel oil II one method alone, chromatography, vac dist, etc., is unsatisfactory. By applying a combination of the different separation methods—urea adduct formation, SO_2 extraction, fractional crystallization, chromatography, thermodiffusion—the mixture is decomp and the whole product may be characterized from the 250 fractions obtained. A method is proposed by which 11·3% *n*-paraffins, and a saturated portion of 58·7% can be isolated, which consists chiefly of 2-ring cpds with side chains of varying length. The remaining 30% forms cpds of clearly aromatic character; in a 2-, 3-, or 4-ring system 1–2 aromatic rings occur. R. T.

2060. Testing inhibited transformer oils. G. Ericson. *Asea J.*, 1958, **31** (1–2), 16–21.—Results given of oxidn of Swedish trans oil, both straight and inhibited with dibutylcresol, by

IEC method (*cf.* Abs. **259**, 1955), but using double cat area and with durations up to 200 hr. Sludge, acidity, Cu content, peroxide No. plotted against time, last best shows induction period (*ca* 110 hr) conferred by inhibitor. Optimum inhibitor concn, as indicated by Swedish (SEN 14–6) oxidn test and measuring sludge and acidity at various durations up to 160 hr (standard test 100 hr), *ca* 0·3%. Comparative tests given on straight and inhibited oils after 9 years service trial, inhibited oil shows less aging (acid val, sap val, peroxide No.), but improvement is less marked than expected from lab tests; inhibited oil dissolved slightly more metals (Cu, Fe) than straight. Modified IEC procedure, using as cat 20 p.p.m. soluble Cu + 20 p.p.m. soluble Fe, is recommended as suitable for determining induction period, which in case of used oils (comparing value with that for new oil) is forecast of remaining life. Oxidn mechanism and earlier work are discussed. V. B.

2061. Gas chromatographer versatile analytical tool in refining-petrochemical operations. Anon. *Petrol. Engr*, 1958, **30** (1), C44.—The use of a lab gas chromatographer for the analysis of gas and liq refinery streams is described. Other applications include the monitoring of petrochemical operations, the isolation of components for further analysis, and the preparation of high purity samples for the calibration of instruments. A. E. R.

2062. Evaluation of wear investigations with the four-ball-apparatus with aid of the interference microscope. (In German.) H. Determann. *Erdöl u. Kohle*, 1957, **10**, 303–5.—The 4-ball apparatus for testing the tear-lessening effect of mineral oils is eminently suitable—since hydrodynamic forces are largely eliminated—for testing gear oils. The lubricant is evaluated either by the load required to produce welding of the balls, or better, by tear severity under definite load. Tear severity is measured conventionally by the dia of the tear scar on one of the 3 lower balls. 2 methods are recommended for investigating the tear calottes using central and edge exposures. By fine adjustment of the interference microscope, with white light illumination, the ht difference shows whether the tear calotte is + or − curved, *i.e.* convex or concave. For relatively smooth surfaces the central method is preferable, for strongly-grooved surfaces the edge method is better. Use of the 4-ball apparatus will be broadened where tear vol measurement of greater accuracy depends not only on dia but also on thickness of the tear calotte. Numerous explanatory exposures are presented. R. T.

2063. Use of radionuclides in chemical petroleum research. (In German.) L. Wiesner. *BrennstChemie*, 1957, **38** (9–10), 142–6.—Following a brief review of the history of unstable isotopes, those used chiefly in petroleum research are named and their characteristic properties noted. Working with radionuclides as radiation sources—compared with indicator experiments—is simple. Precautions to be taken are the same as with an X-ray apparatus. An X-ray apparatus is replaced advantageously by nuclides emitting γ rays. However, isotopes emitting β rays may carry through the TEL determination, since β rays excite the K-lines of Pb. Estimation of the H_2 cont of an oil sample with ^{90}Sr and ^{90}Y—time 20 min—rests on the fact that the ratio absorption cross-section/at. wt. for H_2 is *ca* double that for the other light metals as tabulated. Instruments are produced commercially. Chem and physical problems for whose solution radionuclides are necessary are discussed. Methods for radionuclide-marked cpds are described fully. The importance of isotope effect is discussed. 11 refs. R. T.

2064. A high-precision adiabatic calorimeter. Anon. *Petrol. Times*, 6.6.58, **62** (1587), 474.—A calorimeter for use within the range 30°–500° C is described as developed by the U.S. National Bureau of Standards. G. A. C.

2065. Information on adiabatic exponent determination of low-boiling hydrocarbons at various pressures and temperatures by supersonic velocity measurements. (In German). E. Terres, W. Jahn, and H. Reissmann. *BrennstChemie*, 1957, **38** (9–10), 129–41.—An interferometer for estimating supersonic velocity by supersonant of *ca* 500 kc/s in low-b.p. hydrocarbons is illustrated and discussed. Results are communicated for CH_4, C_2H_6, C_3H_8, C_2H_4, and C_3H_6 at temp 20°, 50°, 75°, 100°, 125°, 150°, and 175° C, and pressures up to 120 kg/cm², with intervals of 10 kg/cm². Calc error—with few exceptions—and independently confirmed, is from 0·2 to 0·5%. Results of the experiments given in extensive tables and charts, and a general discussion on a final dispersion of the sound velocity in the ideal gas are annexed. Laplace's general equation $c_p/c_v = c^2\rho ki$ is applied for calculating adiabatic exponents, the product of d and exothermic compressibility being taken from other authors' pV data. These results are found for the different pressure and temp for the hydrocarbons mentioned, given with an error from 1 to 2%, in exceptional cases 3%. The limited literature data confirm the results. In the appended discussion, the formerly not accurately known adiabatic exponents in the ideal C_3H_8 and C_3H_6 gas between 20° and 200° C, also C_4H_{10} and C_4H_8 at room temp, are given from the authors' measurements. The isothermic course of the adiabatic exponents is discussed and, comparing the deviations of c_p/c_v of different hydrocarbons from their ideal val c_{po}/c_{vo} they are greater with smaller mol. wt. The const of an approximation equation $c_p/c_v = A + B_p + C_p^2$ at temp from 20° to 175° C are tabulated. 53 refs. R. T.

2066. Gas–liquid chromatography: effect of support size and proportion of liquid phase on column efficiency. J. D. Cheshire and R. P. W. Scott. *J. Inst. Petrol.*, 1958, **44** (411), 74–9.—A discussion of the results of previous workers is followed by a description of experiments carried out to determine the correct particle size of the support and the optimum proportion of liq phase to support for max column efficiency. 12 refs. C. B.

2067. The distillation of binary and ternary mixtures. A. K. Qureshi and W. Smith. *J. Inst. Petrol.*, 1958, **44** (413), 137–46.—A wetted wall column was used to separate binary and ternary mixtures at constant flow rate and total reflux. The experiments confirm the results of other workers, that the height of a transfer unit is dependent upon the concn of the mixture. An empirical method of determining column efficiency which allows for the effect of concn is derived for binary mixtures. The more complicated separation of ternary mixtures and its transfer unit theory is described. The apparatus is described, and results given include the refractive index and density at 20° C and equilibrium data for the mixtures heptane–methyl*cyclo*hexane–toluene and acetone–chloroform–benzene. 25 refs. C. B.

2068. Low-temperature burst tests of flash-welded line pipe. Pt III. M. A. Scheil *et al.* *Engng J., Montreal*, 1958, **41**, 64–71.—Burst tests conducted down to −50° F are comparable—as regards ductility and fracture appearance—with similar data for ambient temp. C equiv effect was negligible on the burst tests and on the notch-bar tests. Correlation of pipe performance with the Charpy vee-notch specimens of the material, based on some arbitrary energy val between the upper and lower plateaux of the energy–temp transition curve, is difficult. Whether the pipe is to be in service at +40° F, where there is the longest service record, or at 0° F° the steel is on the lower plateau of the energy–temp transition curve. To obtain shear-type fracture in the burst test, results of a

single test at 180° F would indicate that the pipe should be at a temp high on the upper plateau of the energy–temp transition curve. The average circumferential stretch of the pipe burst at +180° F was ≯ that obtained at atm or sub-zero temp. In some pipes tested, defects—chain marks, etc.—existed up to 12½% of the wall thickness; artificial notches were not made. Pipes burst at 0° or −50° F showed tear but no tendency to shatter. The performance of all pipes—of various steels—tested was comparable and equiv to burst tests at normal atm temp. Fractures were of the cleavage type as illustrated, with chevron markings and no shattering tendency. Steel ductility is shown by elongation or stretch of the pipe circumference. All pipe tested at −50° F developed in excess of minimum mechanical properties of yield and tensile strength required for X 52 expanded pipeline. Use of special low-temp service conditions is justified. R. T.

2069. Cam and tappet test for lubricants. 2. Wear evaluation. E. H. Loeser, S. B. Twiss, and D. M. Teague. *Lubric. Engng*, 1957, **13** (5), 269–74.—Equipment designed for the study of metal scuffng under combined sliding and rolling contact as in the previous paper can be used to evaluate wear before scuffing occurs. The apparatus and modified procedure used for the evaluation of wear as opposed to scuffing using 0·75% of zinc dialkyl dithiophosphate as anti-scuffing additive and calculating wear from Proficorder tracings of mating surfaces of cam and tappet test pieces are described. Increased wear was found to be too small to affect operation of the valve train adversely, and was found to occur to a greater degree on the cam than on the hardened tappet. J. G. H.

CRUDE OIL

2070. Study and research of Ragusa crude petroleum. C. Padovani. *Riv. Combust.*, 1958, **12** (4), 257–78.—Ragusa crude petroleum, which is basically asphaltic, with high visc and scant low-boiling fractions content, was studied principally with a view to its chemical exploitation, in connexion with a scheme for the production of high ethylene polymers.

Lab and pilot-plant tests were made with visbreaking, with pyrolysis in vapour phase to produce gaseous olefins, and vacuum dist to produce bitumen. The results summarized in this preliminary note lead to the choice of a new direct heating cyclic process of pyrolysis which makes direct use of the crude and gives ethylene yields of the order of 20–25% by wt.

Research was also made on deasphalting by a new thermocat method, with which residuum beyond 320° visc can be lowered from 200° to 4° E without appreciably changing the light cut yield. The research done indicated a possibility of converting up to 50% by wt of the crude into high-grade chemical products. (Author's abstract.)

2071. Desulphurization of coke prepared from inland crude oils. F. Sef. *Nafta* (*Yugoslavia*), 1958, **9** (3), 71–6.—In continuing investigations on the desulphurization of petroleum coke, a sample of coke, prepared from Klostar crude and ground to particles less than 0·211 mm and containing 1·98% sulphur and 6·3% volatile matter, has been treated for 160 min with various gases and gaseous mixtures at atm pressure and at temp varying from 450° to 850° C. At a space velocity of 2 l/g/hr, 11·3%, 13·7%, and 7·2% of the sulphur present has been removed with methane, coking gas, and cat cracking gas. Under the same conditions 26·7% of sulphur has been removed with a gas containing 58·4% hydrogen obtained by calcining petroleum coke.

With ammonia similar results have been achieved as with pure hydrogen, *i.e.* 47·1% sulphur has been removed. Ammonia added at temp from 650° to 850° C, other conditions unchanged, removes 62·3% sulphur.

Adding steam to the hydrogen is advantageous at high temp only; at 850° C, 69·0% of the sulphur present has been removed during 160 min with $2H_2 + 2H_2O$ l/g/hr. However, adding of steam causes a comparatively greater loss of the substance.

The granulation of the coke has a considerable influence on the desulphurization. It was found that it is possible to remove nearly twice the same quantity of sulphur from the sample with particles less than 0·211 mm as from a sample with particles from 0·211 to 1·003 mm. Pressure reduces the influence of the granulation. This has been proved by tests to be published later.

By the desulphurization of coke samples prepared from inland crude oils from Mramor Brdo and Bunjani, both containing *ca* 2% of sulphur, approx the same quantity of sulphur has been removed with hydrogen and ammonia as from the Klostar crude. By the desulphurization of coke prepared from Iraq crude, which contains 7·7% sulphur, comparatively better results have been achieved; under the same conditions 59·0% sulphur has been removed with hydrogen, and 77·7% sulphur with ammonia at 650°–805° C.

(Author's abstract.)

GAS

2072. Petrochemicals. 3. Position of chemical production from natural gas. (In German.) E. Boye. *Chem. Z.*, 1958, **82**, 359–62.—Production of natural gas in Germany rose by 53% in 1956 to $3·36 \times 10^9$ cu. m., and a further increase to $2·5 \times 10^{10}$ cu. m. in 1957 was obtained. Production on a large scale began at Bentheim in 1938, and in 1956 $5·6 \times 10^7$ cu. m. were produced at this field. German natural gas consists largely of methane, which is converted to acetylene by pyrolysis in an electric arc using short reaction times. The use of the acetylene, and other products from the gas, as a basis for petrochemical manufacture, is discussed. German techniques are compared with those used in the U.S.A.

P. J. K.

2073. One year of oil cracked gas in Hamelin. (In German.) H. Deneke. *Erdöl u. Kohle*, 1957, **10**, 286–92.—The oil cracking installation in Hamelin—the first of its type in Europe—is described with illustrations. Output for one year is given as 3·5 million m³ gas from 1800 tons of various mineral oils. The process—cat cracking of oil vapours mixed with steam—yields gas similar in composition and cal. val. to town gas. Heating of the installation after stoppages required 127,000 m³ gas. Crude benzene recovered from the cracked gas was *ca* 100 tons. Tentative operating costs are given. R. T.

2074. Gas production at Lacq. R. Enous. *Chim. et Industr.*, 1958, **79**, 725–42.—Field history; geological details (diag); particulars of wells drilled; metallurgical problems caused by 15% H_2S and 10% CO_2 in gas; description (diag) of gas collecting and pressure release system (from 450–500 kg/cm² at well-head to 90–110 at processing plant); well and equipment maintenance (cathodic protection largely used). Hydrate formation is (after initial, and costly, use of methanol) now prevented by injection of diethylene glycol (0·7 g/m³, recoverable). V. B.

ENGINE FUELS

2075. Constituents of motor fuels. Anon. *Petroleum, Lond.*, 1958, **21** (4), 124–7.—Research work on the methods of alleviating combustion chamber deposits, which detrimentally affect the performance of automotive engines, is summarized. Surface-ignition, caused by combustion deposits, increases with high-boiling aromatic content of the fuel, but may be

reduced by additives, mainly phosphorus cpds. Some additives were found to increase spark-plug fouling tendencies. Trialkyl phosphines reduced the increase in O.N. required to prevent knock in an engine with deposits compared with a clean engine. Trialkyl phosphines are completely miscible with petrol, are not extracted by water, and are not corrosive. A. E. R.

2076. Radio-tracer studies of engine deposit formation. C. N. Sechrist and H. H. Hammen. *Industr. Engng Chem.*, 1958, **50** (3), 341–2.—A set of experiments designed to study the deposit-forming characteristics of un-leaded fuels, fuel components, and various lubricants in a C.F.R. motor engine is described. To help establish the source of the deposits, fuel components tagged with carbon 14 were used in some of the experiments. Details of the equipment used and of the engine test procedure, method of collection of deposits, and radio-assay procedure are given. The results are tabulated and discussed with regard to what additional information the radio-tracer technique makes available. D. K. R.

2077. Diesel combustion chamber deposit formation. P. D. Hobson. *Industr. Engng Chem.*, 1958, **50** (3), 337–40.—Description is given of experiments performed to discover the causes of diesel combustion chamber deposits, and the effect on the amount and nature of the deposits of variation of fuel type and engine loading. Tests were principally done with *n*-hexadecane, 1-methylnaphthalene, and decahydronapthalene. Details of the equipment and experimental procedure used are given. The results are given under the headings of the fuels used, and then discussed with particular reference to the formation and composition of the deposits, the carbon particle size, and the effect of variation of the O.N. It is concluded that the deposits result primarily from pyrolytic reactions of the fuel mol. These reactions depend on mol structure, and paraffins tend to produce less deposit than do cyclic hydrocarbons. The more objectionable deposits are produced under low engine loading. D. K. R.

GAS OIL AND FUEL OIL

2078. Prevention of discoloration and sludge formation in catalytic furnace oils. K. A. Buchanan, R. H. Bruggink, and C. D. Lowry, Jr. *Petrol. Engr*, 1958, **30** (2), C19–22.—The colour and stability of a furnace oil largely produced by cat cracking were improved by washing with a strong caustic soln. Severe cracking operating conditions were found to adversely affect the quality of the oil, and these conditions were avoided by lowering the end point and sharpening fractionation. A test which determines the effect of a short period of storage at moderate temp on the oil was devised to act as a guide for treating operations. A. E. R.

LUBRICANTS

2079. Central air-borne lubrication systems. Anon. *Lubrication*, 1958, **13**, 197–204.—Unconventional systems are discussed and illustrated in which air is the lubricant carrier. Modern application methods—described and illustrated—lead to lower operation and maintenance costs, and high production rates. Centralized air-borne lubrication systems—relatively new and limited in application—are rapidly taking their rightful place in this field. R. T.

2080. Prediction of pressure drops in pressurized greasing systems. E. F. Koenig, E. M. Johnson, and E. A. Baniak. *Rev. Inst. franç. Pétrole*, 1958, **13**, 289–308.—Apparent visc of 7 greases (properties tabulated) were determined at various rates of shear by means of a pressure viscometer (S. O. D., *cf.* ASTM D 1092–55), and graphs (on log–log scales) of apparent visc against rate of shear are given for 77°, 50°, and 32° F. An industrial system was simulated by coupling a cyl, which could be pressurized by a pump, to a Cu delivery line. Pressures required to give various rates of delivery of each grease at 77°, 50°, and 32° F, through different lengths of tube of dia ¼-, ⅜-, and ½-inch were measured. By substituting apparent visc for visc in Poiseuille's formula, and using dia calc from Poiseuille's formula by using oil of known visc, an expression was obtained from which rate of shear could be derived. Nomograms are given for converting rate of flow to rate of shear for each dia tube. Curves of pressure drop against flow rate and curves derived therefrom of pressure drop against apparent visc enabled nomograms to be constructed for ¼-, ⅜-, and ½-inch tubing, relating pressure drop (p.s.i/ft and g/cm².cm) to apparent visc and flow rate. Experiments were also carried out using various settings of a Trabon distributor (outputs 10–120 ml/min), and a similar nomogram is presented for this case. W. A. M.

2081. Numerical solution of Reynolds' equation for sector thrust bearings. B. Sternlicht and H. J. Sneck. *Lubric. Engng*, 1957, **13** (8), 459–63.—A numerical method using a 650 IBM digital computer is presented for the solution of Reynolds' equation for sector thrust bearings. Results so obtained agreed well with these of other authorities; other possible applications of the digital computer in this field are indicated. J. G. H.

2082. Grinding temperatures. J. E. Mayer and M. C. Shaw. *Lubric. Engng*, 1957, **13** (1), 21–7.—Previous methods of measuring grinding temp are outlined, and it is considered that the temp at the surface during grinding is of major significance in the study of wheel wear and of formation of surface cracks in a hardened workpiece during grinding. Details and illustrations of a lead sulphide cell circuit used in conjunction with an oscilloscope are presented, and the procedure employed in the use of this unit to measure surface temp is described. Interpretation of results so obtained is explained, and data obtained with various grinding fluids are presented and discussed. 21 refs. J. G. H.

2083. Lubricant tests by photography. Anon. *Oil Eng.*, 1958, **25** (295), 410–11.—The Ministry of Supply Inspectorate of Fighting Vehicles test for rating the performance of lub oils is described. The test consists of securing reflex paper, with an emulsion coating on the inside, to the piston, and placing a yellow plastic filter round the paper so that a light of high intensity directed on the piston will act on the emulsion only when it is reflected back from the piston surface. The piston is mounted on a motor-drive turntable, lit by 4 Photoflood lamps. The sensitive paper is then developed and printed. The whole process takes from 10 to 20 minutes, and the test is considered by the Inspectorate to give superior results to any other merit system rating. C. B.

2084. Planned lubrication for three plant types. R. W. Clark. *Lubric. Engng*, 1957, **13** (7), 384–6, 414.—Du Pont's lubrication programme is described. This comprises a centralized lubrication group for integrated one product plants, decentralization for plants of the non-integrated type with diversified operations, and lubrication by diversified operations and lubrication by process operators or maintenance personnel in very small plants. Essential points of an organized lubrication programme are set out; schedules, training of personnel, and selection of lubricants are discussed. J. G. H.

2085. Circulating oil systems. R. E. Forsythe. *Lubric. Engng*, 1957, **13** (8), 443–5.—Essential components and design features of oil circulating systems are briefly described,

filter and general maintenance schedules are outlined, and points to be checked for possible operating difficulties are set out. J. G. H.

BITUMEN, ASPHALT, AND TAR

2086. Rubberized asphalt experiments. F. B. Odasz and R. V. Witter. *Rds & Str.*, June 1958, **101** (6), 128.—New methods are described of measuring chip retention and evaluating wear under traffic which have been developed during the study of surface treatments. G. A. C.

2087. Changes in the properties of an asphalt during the blowing operation. L. R. Kleinschmidt and H. R. Snoke. *J. Res. nat. Bur. Stand.*, 1958, **60** (3), 169–72.—An asphalt flux was converted to a coating-grade asphalt by air blowing. Physical properties and component distribution were determined on the flux, the product, and components. The separation of the products into components is described, and the following ASTM tests were carried out: soft. pt, penetration, ductility, visc, sulphur, iodine No., and coke residue. 2 refs. C. B.

2088. Guide to selection of coal tar coatings for protection of metals underground. Pt 2. N. T. Shideler. *Petrol. Engr*, 1958, **30** (4), D29–32.—4 main types of cold applied coal tar coatings are described which protect underground metallic structures from corrosion. Conditions of exposure of the coating to investigate are listed to enable a correct choice, and the most durable coating is recommended for various troublesome soil conditions. A. E. R.

SPECIAL HYDROCARBON PRODUCTS

2089. Hydrocarbons from petroleum. F. D. Rossini. *J. Inst. Petrol.*, 1958, **44** (412), 97–107.—An historical review of the development of petroleum is followed by a brief account of the work of the API. A description is given of experiments carried out under API Project 6, on the fractionation, analysis, and isolation of the hydrocarbons in petroleum, the development of fractionating processes, and the preparation and purification of Standard Research Hydrocarbons for identification, spectrometer calibration, and measurement of physical properties.

Fractionating processes are described in detail, and include dist, extraction, adsorption, and crystallization methods, and the formation of mol or clathrate cpds. Tables give the distribution by type, boiling range, and number of C atoms of the 159 hydrocarbons isolated so far, and the amount of the representative petroleum and its principal fractions constituted by these hydrocarbons. The relative amounts of the several classes of hydrocarbons in broad fractions of petroleum are given, and the 159 hydrocarbons, their type, b.p., purity, and estimated vol in crude petroleum are listed. C. B.

2090. Pressures in sealed transformers and their effects on electric strength of oil. E. B. Franklin. *Rev. gen. Elect.*, 1958, **67**, 71–83.—Discussion of pressure effects and tests on a sealed 15-kVA gas (air) blanketed transformer. Pressure/time diagrams are given, and curves of supersaturation, which, owing to bubble formation, has adverse effect on elec strength of oil; diagram of lab layout. Results of 200 tests are plotted as potential gradient of bubble formation as function of difference between pressure of dissolved gas and static pressure of oil, results are similar for air, N_2, CO_2. Adverse effect of supersaturation can be avoided by degassing oil prior to filling transformer or else using gas (CO_2), the Bunsen coeff of which decreases with increasing temp. Math expressions for calc the various pressures involved are given. V. B.

2091. Modern types of 380 kV transformer bushings. H. Kappeler. *CIGRE*, 1958, *Paper No.* 126, 18 pp.—Sect. IV (4 pp.) deals with elect stress in thin oil layers and gives plot of breakdown (50–250 kV/cm) as function of stressed vol (10^{-2} to 10^3 ml) at 20° C. For given oil vol elect strength decreases as electrode area increases. Curve is also given relating increasing stress (80–350 kV/cm) in oil (both gas-saturated and degassed) at initiation of gas bubble formation to decreasing (6–0·2 mm) oil layer thickness. V. B.

2092. Some comparative considerations on new impregnating materials for capacitors. H. Elsner. *CIGRE*, 1958, *Paper No.* 130, 11 pp.—Suitability of mineral oil as capacitor impregnant is linked with its gas-absorbing properties, a function of aromatic content. Gas absorption (H_2 atm) test results on 5 named oils are given and compared with furfural index (*cf.* Abs. **488**, 1954); oil of highest gas absorption and furfural index was insufficiently stable (aging at 100° C for 100 hr). Electric strength can be increased *ca* 40% by pressure increase to *ca* 3 atm. 18 refs. Remainder of paper discusses chlorinated diphenyl capacitor impregnants. V. B.

2093. Polyethylene-wax coatings. G. S. Peacock, W. G. McKnight, and J. M. Austin. *Mod. Packag.*, Jan. 1958, **31** (5), 137.—The functions are studied of low density polyethylene resins used as wax modifiers to meet specialized requirements in paper coatings. Addition of soft, low-density polyethylenes to paraffin waxes yields products with tensile strength greater than that of components, up to 4% concn, and gloss retention is aided. Graphs show cloud points, visc, and moduli of rupture of various blends. G. A. C.

DERIVED CHEMICAL PRODUCTS

2094. Acrylonitrile manufacture from petroleum by direct synthesis. P. W. Sherwood. *Chim. et Industr.*, 1958, **79**, 743–8.—U.S. production (1958, planned) 135,000 tons. New plants are based on direct ($CuCl/NH_4Cl$ catalysed) combination of C_2H_2 and HCN, latter obtained by partial combustion of CH_4 in presence of NH_3, whilst C_2H_2 is yielded by partial oxidn of CH_4. Process conditions and yields are given. V. B.

2095. Petroleum-derived chemicals in W. Europe. Anon. *Chim. et Industr.*, 1958, **79**, 689–93.—Primary chemicals (1959) 1 million tons from $770 million plant investment, distributed ($ million) U.K. 250, France 180, Germany 180, Italy 125, others (mainly Benelux) 35. Forecast for 1963, 1·5 million tons products, 10^9 investment. Main tonnage represented by polyethylene (1962, 300,000); syndets (1956, 580,000 (40% of total detergents), of which 95% based on DDB sulphonate); synthetic rubber, 1963 estimated requirements 250,000 GR-S and 60,000 butyl. V. B.

2096. Development of the petroleum chemical industry in Britain. R. Holroyd. *Chem & Ind.*, 1958, 900–9.—Castner memorial lecture, includes flow sheet for ICI Wilton olefin plant, table of U.K. petroleum chem plants (existing and announced) and their products, and total production capacity of such plants in respect of 12 main groups of materials; C_2H_2 is so far not included. V. B.

2097. Quick HCl chill highlights new perchlor process. C. H. Chilton. *Chem. Engng*, 1958, **65** (9), 116–20.—A new process making perchloroethylene for use in dry cleaning is described. Capable of using any cheap hydrocarbon feedstock, it is based on a one-step vapour phase chlorination followed by rapid chilling of reaction products in aq HCl. The process is expected to supersede older 4-step processes based on acetylene. P. J. O.

CORROSION

2098. New optical methods spot hidden corrosion. R. B. Norden. *Chem. Engng*, 1958, **65** (8), 170–4.—Various techniques for checking on corrosion in inaccessible places are described. Borescopes for examining the inside of pipe are available down to 0·125 inch dia, or up to 50 ft long, and flexible models are available for looking into curved or crooked bores. Used with an extreme wide angle lens, coupled to a 16-mm cine camera, borescopes provide a film which gives the impression of travelling down a large well-lighted tunnel. Special microscopes are available for detailed examination of pitting at distances up to 8–24 inches from the microscope. Corrosion on the surface of metal cyl can be photographed by special cameras to give a record of the whole surface. Various methods of stereo viewing and measurement from stereo photographs are described. Finally, a method of making cheap replicas of a corroded surface on cellulose acetate film is described. Wetting the metal surface with acetone and pressing the film into contact with it gives a replica which shows fine detail even under an electron microscope. P. J. O.

2099. A special N-80 steel tubing developed in France to resist sulphide stress corrosion in sour gas wells. L. Cauchois, J. Didier, and E. Herzog. *Corrosion*, 1957, **13** (4), 263–9t.—At Lacq, in France, where H_2S content of gas is 15%, broken tool joints in drill pipe showed both transversal and longitudinal cracking. Due to the susceptibility to atomic hydrogen embrittlement of N–80 steel, even when coated and inhibited, a steel having the same mechanical properties but with higher sulphide resistance was developed. This is known as APS 10 M4 and is a Cr–Al–Mo alloy, heat-treated to produce a thermodynamically stable carbon-free ferrite structure with highly dispersed fine carbides. Stress corrosion tests carried out were Jones Test, Cantilever Beam Test, U-Bend Test, Expansion Test, and Tensile Tests, of which Tensile Tests were found to be the most significant. H_2S exposure was achieved by: (1) gaseous H_2S at ordinary pressure and room temp; (2) H_2S in aq soln; and (3) H_2S under 1423 p.s.i. at 175° F. APS 10 M4 was found to be very resistant to high H_2S concn compared with conventional N–80 steel and other materials tested. Tubing made of APS 10 M4 was tested in the Lacq field for 6 months using Kontol No. 230 as inhibitor, and confirmation that this material resisted the severe conditions was obtained. Further tests are planned. F. M. G.

2100. Coatings for crude oil tank bottoms. R. M. Carter. *Corrosion*, 1957, **13** (4), 270–6t.—Tank bottom coating materials should withstand deterioration for an indefinite period under normal tank conditions and should be able to accommodate adverse job conditions as well as being practical and economical to apply. A lab procedure for screening new coating materials is described, and when this was used to study the effect of a high aromatic crude oil and brine on various coatings a catalytic setting coal tar–epoxy resin cpd was found to be superior to hot applied coal tar coatings. The effect of plasticizers and inert fillers on the properties of hot applied coal tar coatings is discussed. For "thin film" coatings a minimum thickness on plate surfaces of 15–20 thou. with an additional build-up on joints is recommended. Chemical curing of these coatings appears the most promising method, and for them to compete with hot coal tar coatings there should be little likelihood of underside corrosion, general cleanliness, conditions for fast curing, and welded rather than riveted joints. Sandblasting before, and holiday testing after, application are recommended, and excess primer should be avoided. Further methods of protection include cathodic protection in conjunction with coatings, galvanizing (limited to small bolted tanks), and the use of inhibitors, which appears at present to be impracticable. F. M. G.

2101. Effect of variables in laboratory testing of corrosion inhibitors for refined petroleum products. D. B. Boies and J. I. Bregman. *Corrosion*, 1957, **13** (4), 277–82t.—Lab tests for evaluating corrosion inhibitors should simulate actual conditions. A series of tests to study inhibitors over a wide range of conditions has been developed. 3 basic tests (static, mildly agitated, and vigorously agitated) using mixtures of hydrocarbon, water, and inhibitor are described. These tests may be adapted to study the effects of variables such as temp, dissolved air, and total dissolved solids. F. M. G.

2102. Corrosion measurements in a hydrogen sulphide–water absorption pilot plant. B. W. Bradley and N. R. Dunne. *Corrosion*, 1957, **13** (4), 238–42t.—A programme of corrosion testing carried out in a water absorption pilot plant for sweetening a high content H_2S gas is described. The plant operated intermittently over 7 weeks with short shut-down times and, except when changing from rings to bubble caps, the environment was oxygen-free. Weight loss of carbon steel appeared to be greatest, as expected, in the bottom of the absorber section and, except in the flash tank, corrosion rate dropped off with time, probably due to the formation of a protective iron sulphide scale. Hydrogen blistering was observed on a number of samples. Measurements with hydrogen probes showed a decrease in pressure build-up rates over an 18-day period, agreeing with the decreased corrosion rate. Tests to show weight loss and susceptibility to sulphide corrosion cracking of various alloys were carried out, and Inconel, K-Monel, and Type 304 (18–8 Cr–Ni) stainless steel were found to be the best of those tested. Tests on 2 inhibitors indicated that a water-dispersable amine type was better than a water-soluble, oil-insoluble imidazoline type. Recommendations on materials for corrosion control on a commercial unit are included. F. M. G.

2103. Plastic panels for tough plant conditions. R. B. Norden. *Chem. Engng*, 1958, **65** (9), 152–6.—The use of corrugated sheets of fibreglass-reinforced plastic for plant construction is described. Particularly useful where sudden temp changes or corrosive fumes are common, they are also cheap, lightweight, and translucent. Details of important properties, sizes available, and prices are given. P. J. O.

2104. "Bitugel," new anticorrosive bitumen composition. E. A. Duligal. *Corrosion Tech.*, 1958, **5**, 152–5.—Advantages of petroleum pitch coatings are waterproofness, elect insulation, and cheapness, which render them suitable for corrosion protection on large steel structures where appearance is not important. The degree of protection depends on surface preparation and coating thickness. Disadvantages of normal bitumen soln are limited temp range, solubility in oils and solvents, and unattractive appearance. Application of multiple coats introduces danger of entrapping acidic moisture between the coats. Hot or heavy pitch coatings are unsatisfactory owing to high visc. Resistance to heat and cold may be improved by modification with oils and/or mineral fillers. Bitugel, a petroleum pitch with extreme thixotropic properties, enables a thick coating to be brushed on, which sets so rapidly that it cannot sag. Further advantages are protection against multiple corrosion causes—better than many well-known petroleum pitches—flow resistance on heating, flexibility, and good adhesion. Possible applications are considered. R. T.

2105. Corrosion in cat reformers with naphtha pretreaters. E. B. Backensto and R. W. Manuel. *Oil Gas J.*, 19.5.58, **56** (20), 131.—It is shown that desulphurization of the charge to below 0·002% wt sulphur would reduce high-temp hydrogen sulphide corrosion of carbon and low chromium steels to a negligible level in the reforming section. G. A. C.

ENGINES AND AUTOMOTIVE EQUIPMENT

2106. Design of pistons and piston rings. G. H. Clark. *Sci. Lubric.*, 1957, **9** (9), 18–25.—Importance of sound piston and piston ring design in the effective operation of marine engines is emphasized, and the connexion between sound piston design and efficient cooling is discussed. Practical points in piston ring design are indicated, and ring flutter and bedding-in are considered in some detail. The functions and design of scraper rings and of piston rod glands are described and illustrated. J. G. H.

SAFETY PRECAUTIONS

2107. Ignition of compressed acetylene by pipe rupture. H. Lagarde. *Chim. et Industr.* (*Génie Chim.* suppl.), 1958, **79**, 83–8.—To investigate whether rupture of pipe containing compressed C_2H_2 causes ignition, experiments were carried out using mild steel pipes, 150 mm long, i.d. 5 mm, o.d. 8 mm, as used industrially for connexion to cyl during charging. Connexions were fitted to each end of the tube to allow purging of air and charging with C_2H_2; weak spot was made by reducing wall thickness of small section to 0·4 mm. Rupture of charged tube was effected by dropping 10 kg wt 3·15 m on to lever which caused tube to elongate. After a few sec supply valve on C_2H_2 cyl was rapidly closed by remote control. Detailed descriptions and diagrams are given of this N_2-controlled valve and of set-up. Conditions of 104 experiments, covering pressure range 160–280 p.s.i.g., are tabulated. In no case did ignition of C_2H_2 occur. W. A. M.

2108. Airplane overheat detector goes industrial. C. C. van Soge. *Chem. Engng*, 1958, **65** (8), 78–82.—A thermistor-type overheat detector which has been widely used in aircraft is now finding application in petrochemical and other plants. The detector is strapped to a reactor wall so as to cover large areas of it, and operates an alarm if any small area of the wall becomes too hot. P. J. O.

2109. Safing of storage tanks by the absorption method. W. W. Colket. *Pipe Line News*, 1958, **30** (4), 28–30.—Before tanks which have been used for storing inflammable liq in the petroleum industry can be cleaned, repaired, or dismantled they must be made safe. Failure to do this may result in serious accidents, leading to loss of life as well as of materials. The procedures used by the Sun Oil Co. are described. Tanks are dealt with as being in one of 3 classes: (1) having stored products with fl. pt. above 125° Closed Cup Flash; (2) having stored products with fl. pt. below 125° Closed Cup Flash; (3) having stored products containing TEL, which are regarded as contaminated until cleaned, regardless of previously stored product. The procedure of principal interest is that used with the second class of tanks, when, after pumping down and stripping the tank as much as possible, absorption oil having a minimum fl. pt. of 150° F is pumped in and left for up to a week to allow it to absorb the lighter hydrocarbon. Variations of procedure used with cone-roof and floating-roof tanks are described. D. K. R.

2110. Prevention of industrial dermatitis in a motor truck plant. N. H. Schell. *Lubric. Engng*, 1957, **13** (4), 197–8.—Preventive measures in force at the Fort Wayne motor truck plant of International Harvester are briefly described. Special features include test procedure and pilot equipment for the investigation of new coolants and allied products, a coolant control system, and a competitive element in good housekeeping. J. G. H.

ECONOMICS AND MARKETING

2111. For 1958—moderate gains in demand. V. B. Guthrie. *Petrol. Engr*, 1958, **30** (1), C7–10.—A relatively small gain in demand for refined products is forecast for the U.S.A. in 1958. Competition from natural gas is reducing the number of new domestic oil burner installations. Other factors are listed which have slowed down expansion since early 1957. The rate of growth in demand for petroleum products is expected to remain steady for the next 5 years, and considerable new facilities will be required for increases in refining, transportation, and marketing. A. E. R.

2112. Cyclic fluctuations and black oil demand. G. Chandler and D. A. Lindsell. *J. Inst. Petrol.*, 1958, **44** (413), 109–23.—A study has been made of economic fluctuations and their impact on the oil industry and black oil demand in particular. An analysis is given of the 1930 depression and the 2 U.S. recessions of 1948–49 and 1953–54, and their effect on world-wide trade.

The changes in black oil and coal consumption are considered in relation to industrial production for the U.S.A. and W. Europe. The importance of the end-use of the fuels is discussed and speculations made as to the nature and impact of future economic fluctuations. Appendixes give the mathematical methods used in the study and discuss the factors affecting bunker demand. 6 pages of discussion. C. B.

MISCELLANEOUS

2113. The world's uncharted energy resources. G. Tugendhat. *Petrol. Times*, 20.6.48, **62** (1588), 498.—The question of petroleum resources, natural gas, and shale is examined in the light of new knowledge of where reserves are to be found, modern methods of recovery, oil marketing conditions, and nuclear reactions. G. A. C.

2114. Longitudinal mixing of fluids flowing in circular pipes. O. Levenspiel. *Industr. Engng Chem.*, 1958, **50** (3), 343–6.—The problem of longitudinal mixing of fluids flowing in circular pipes is discussed, and relationships predicting the amounts of mixing in the cases of streamlined and turbulent flow are given. Design charts are given incorporating the data available in the literature on this subject, and the conditions of applicability of the equations are discussed. D. K. R.

2115. Concurrent flow of air, gas-oil, and water in a horizontal pipe. D. P. Sobocinski and R. L. Huntington. *Trans. Amer. Soc. Mech. Engrs*, 1958, **80** (1), 252–6.—An investigation is described into 2-phase and 3-phase concurrent flow in a

3-inch i.d. tube. The apparatus used is described, and the results obtained are discussed. The measurement of frictional losses and the types of emulsion formed are described. A correlation is derived between 2- and 3-phase flow relationships. 5 refs, one page of discussion. C. B.

2116. Japan's rising needs. Anon. *Petrol. Press Serv.*, 1958, **25**, 133–6.—Japan is the 6th largest oil consumer in the free world, and her needs for liq fuels are increasing faster than in any other major market. Her consumption jumped from <4 million tons in 1952 to an expected 6 million tons this year, and by 1963 >25 million tons. Continued industrial expansion, rising population, and limited energy resources at home promise a continued sharp expansion of oil imports. Increase in the number of trucks and buses will be important in increasing demand for gas/diesel oils which, with extended rail dieselization, is expected to reach 4·4 million tons by 1963. Kerosine consumption is expected to double in the next 5 years, having risen from 66,000 tons in 1950 to 740,000 tons in 1957. The overall fuel picture favours the fast-growing use of kerosine for heating and cooking. Fuel oil and diesel oil already account for *ca* ⅔ of total inland demand. Japan's economy—originally based on coal—shows increasing preference for fuel oil. However, the advance of fuel oil has been checked by official measures to avoid adverse repercussions on the local coal industry. Increase in fuel oil consumption is expected in both industry and electric power generation. Persistent shortage of foreign exchange has led Japan to seek interests abroad, and to increase her refinery capacity. During the next few years a petroleum chem industry—already started—will be developed. R. T.

2117. Consolidation in Sweden. Anon. *Petrol. Press Serv.*, 1958, **25**, 136–9.—Sweden's consumption of liq fuels—at *ca* 8¼ million metric tons last year—was slightly lower than in 1956, but 8-fold the pre-war level. The decline was due to the Suez crisis and unusually mild weather, which also favoured the hydro-electric power stations to the detriment of coal and oil. Oil consumption is expected to double or possibly treble during 1955–80, depending on hydro-electricity and nuclear power development. Sweden is one of the few European countries where oil has ousted coal as the main fuel for industrial and domestic uses. Before world war II black oil consumption was *ca* 300,000 tons; in 1957 the total was 6,270,000 tons, whereas coal consumption fell considerably. With continued house-building the demand for oil increases. Another feature of Sweden's economic and social advance is the expansion of motor transport. Sweden is already the most highly motorized country in Europe, and it is forecast that, in 8 years, the number of cars will have risen by 75% to 1½ million, and of commercial vehicles by 20% to 150,000. Serious financial burdens from imposition of compulsory reserve stocks—a necessary provision—are faced by the highly-competitive local oil industry. R. T.

BOOK REVIEWS

The Middle East: a Political and Economic Survey. Third Edition. Ed. Sir Reader Bullard. London: Oxford University Press (for Royal Institute of International Affairs), 1958. Tables, charts, maps. Pp. 569. 45*s*.

It is very satisfactory that Chatham House, employing a most reliable and highly-qualified editor (Sir Reader Bullard, former Ambassador to Persia and life-long resident in the Middle East), has issued a third edition of its Middle Eastern Survey. This, first produced in 1950, has been subsequently reprinted and revised, and the issue now before us represents the facts and figures up to the last quarter of 1957—though some statistics, regrettably but no doubt unavoidably, cover only a rather earlier period. The formation of the United Arab Republic and the Iraqi–Jordan Federation are mentioned in a stop-press postscript dated 26 February 1958, together with certain other events of late 1957 and early 1958.

The area covered by separate chapters, one per territory, after a very valuable introductory chapter of 72 pages covering vital aspects of the whole region, omits Libya—Middle Eastern in so many ways, but not geographically—but includes, in addition to the obvious candidates, the Sudan and Cyprus; within Arabia, it offers separate subchapters for the Sa'udis, the Yemenis, Aden colony and protectorate, Qman, and the Gulf Shaikhdoms. There is in fact no Middle Eastern territory to which it can reasonably be felt that justice has not been done. The task of selection and compression must have been formidable; the full space which it was possible to allot to each territory (an average of 42 pages) could very easily have been devoted to its history, or its politics, or resources, or society, or geography, alone; but all must be covered, and the consequent inevitable omissions and simplifications cannot hope to satisfy every reader, though the best has been made of a most difficult task. There is enough uniformity and symmetry of treatment for each country, required information is easily found by suitable paragraphing (and an excellent table of contents and index), and, within human limits, few will turn from the book unsatisfied. The sections dealing with oil have been carefully compiled, under evidently knowledgeable editorship, and represent almost the latest picture, clearly and accurately drawn. The same appears to be true of other economic sections.

It is in accordance with the standards to which Chatham House publications normally conform that the style of this compilation is clear and readable; it can, indeed, apart from its function of supplying concise up-to-date information, be read in its own right as a pleasantly informative work. The writers whom Sir Reader collected for the task are (as the preface, with their names, tells us) in many cases the leading authorities on their respective countries, and the occasional services of a formidable team of experts were also invoked on specific matters. The historical and social chapters are models of their kind, the political material objective and well arranged, and the economic data as satisfying as space allows. S. H. L.

The Technical Development of the Royal Dutch/Shell 1890–1940. R. J. Forbes and D. R. O'Beirne. Leiden: E. J. Brill, 1957. Pp. 670 + x. 75 guilders.

This book covers a somewhat wider range than is suggested by the title. It is an extensive treatise on the history of petroleum in which some aspects are presented primarily from the point of view of the Shell organization. The frank presentation of the facts enables the reader in imagination to look over the shoulders of directors and to pass judgment on the wisdom or otherwise of the many important policy decisions required during the rapid march of progress of the petroleum industry. Examples of this are the remarkable faith and energy devoted to the development of petrochemicals and cracking and polymerization processes, the tardy adoption of rotary drilling techniques, and the reluctance to use TEL for octane improvement of gasolines until the outbreak of the second world war.

In a work of this kind many specialists have contributed both to the text and in the supply of photographs and

diagrams, and obviously many of the company records have been drawn upon.

The introductory chapter is a valuable contribution to the literature covering the world history of petroleum prior to 1890 and includes relevant aspects of organic chemistry. The section on geology and prospecting is largely concerned with the former Dutch East Indies. In the chapter on drilling there are excellent illustrations of drawworks, and an appendix gives details of various drilling systems including the KNPM, which was specially developed for primitive conditions.

An interesting aspect of the chapters on refining and products is the interplay between developments in the East with those in the American continent. The influence of patent rights on the evolution of cracking processes is well described. The most serious product quality problems involved kerosine, and these were recurrent until the invention of the Edeleanu SO_2 treating process. Early unhappy experiences with lubricants and greases appear to have retarded entry into this " alchemistic apothecary's trade."

The petrochemicals chapter is a success story in spite of the world trade recession which took place during the time. Details are given of the German and Californian contributions in addition to those of Holland. After a detailed section dealing with tankers and transportation, the volume is concluded with a brief introduction to the trends in petroleum developments subsequent to 1940. L. G. M.

Guide du Pétrole et de son Equipement. Tome I. Annuaire. Paris: Editions O. Lesourd, 1958. Pp. 940. Fr. 5500 (+ postage 220).

This guide is steadily expanding with the growth of the French petroleum industry, and the two volumes of the edition last noticed (*J. Inst. Petrol.*, 1956, 84A) have now increased to three. The first of these, the " Annuaire " section, is a comprehensive directory covering France, French North Africa, and French overseas territories. It is divided into a number of sections (prospecting and production, transport, refining, importation, lubricants, LPG, miscellaneous products), in each of which information (including financial) is given on the various companies, trade associations, and other organizations concerned. In addition, there is a buyers' guide of petroleum equipment, a petroleum telephone directory, a list of trademarks, a " who's-who " of the French petroleum industry, as well as a number of entries concerning some of the more important foreign companies and organizations. The two other volumes, scheduled for towards the end of 1958, will deal with " Techniques, pétrochimie, et matières plastiques " and with " Règlementation." V. B.

The Performance of Metal Cutting Tools. R. Tourret. London: Butterworths Scientific Publications, 1958. Pp. vii + 184. 50*s*.

The author reviews published information on the mechanical and physical performance of metal cutting tools. The book is arranged in four sections dealing with definitions, theory of continuous chip formation, tool life, and surface finish. The relevant information on each of the variables involved is given in separate sub-divisions within each main section. This gives an agreeable logical overall arrangement, easy to follow. The author, however, has chosen to present the factual information with a minimum of comment. This gives the reader the chance to form his own conclusions from the data presented. It seems regrettable, however, that the work has not been rounded off by some critical conclusions and assessments from the collected data.

The book, expecially the first section, will provide an easy and informative work of reference to anyone interested in the definitions and terminology of machining practice.

R. G.

Successful Process Plant Practices. Robert L. Davidson. New York, Toronto, London: McGraw-Hill Book Co. Inc., 1958. Pp. xxii + 302. 77*s*. 6*d*.

The constant day-to-day small problems of a process plant depend for their solution on the ingenuity of the individual operator or plant engineer. These difficulties are usually not so large that their solution produces an appreciable increase in plant efficiency and production, but their continued unsolved presence can be aggravating and upsetting. On many occasions the thought occurs that this cannot be a unique problem but must be one that has been met before and probably satisfactorily solved by others. Who it is that has tackled the problem and how they went about it and reached a solution is often far from easy to discover.

In his book Mr Davidson has attempted to highlight some common difficulties for which satisfactory working solutions have been found. He ranges through the areas of personnel training and safety, and maintenance and equipment production to small operating hints. His information is derived entirely from reports in *Petroleum Processing* over the past twelve years covering practices in oil refineries and petrochemical and natural gasoline plants. It is presented not as a " pedantic compilation of theory and formula " but rather as an attempt to pass on to others through a collection of 340 plant practices experiences derived from 63 companies and 97 separate process plants. This book, being a compendium of small articles, is obviously not intended for continuous reading, but should be regarded as a preliminary practical reference book available as a starting point for tackling a plant problem. It is a book which can be used to stimulate ideas, to point out improvements in present methods, and possibly even to show the existence of a plant problem.

A practical book of this type should be available for ready reference in the many field locations where the work is to be done. J. P. W.

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OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

2118. Time stratigraphy. H. E. Wheeler. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (5), 1047–63.—As in lithostratigraphy and biostratigraphy, time stratigraphic units may be classed on the basis of their vertical, lateral, and vertico-lateral contiguity.

Those space–time units defined by their position in vertical succession are of 2 kinds: (1) units of variable time value without specific time limitations, including holcstrome, hiatus, lacuna, and erosional vacuity; and (2) units of constant max time limits, including (*a*) units of constant time value, such as era, period, epoch, and age, and (*b*) units of variable time value within specified max time limits, such as system, series, and stage. E. N. T.

2119. New way to locate stratigraphic traps. D. W. Slattery. *World Oil*, 1958, **146** (5), 140.—Recently developed radio-geophysical techniques are said to be capable of mapping conventional structures and also stratigraphical traps. They have been useful in areas where other geophysical methods have given uncertain results. The new methods do not map structure but are used to detect secondary effects associated with oil or gas accumulations. One of the effects is the geochemical halo above the accumulation. This can be detected by radio-induction, and measurements are not influenced by surface alteration as they are in geochemical prospecting. Examples of radio-induction surveys are given, with maps, and it is claimed that the method can be expected to be 50% successful, based on mineralization haloes. C. A. F.

2120. Stratigraphic facies differentiation and nomenclature. J. M. Weller. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (3), 609–39.—Growing interest in stratigraphic facies relations has resulted in the proposal of numerous terms intended to distinguish different kinds of facies. Instead of promoting

accuracy in thinking and expression, however, this has resulted in much confusion because little agreement is evident in the current usage of facies terms. 24 terms are listed, together with the varying definitions that have been presented for them and illustrations of their varied use.

The 24 facies terms are re-examined to determine their usefulness and necessity. The conclusion is reached that only 2 are important in application to stratigraphy. These are facies and lithofacies, which are re-defined in such a way that each can be used in more than one sense without confusion. A few other terms may be useful in special situations or in theoretical considerations, and definitions are provided for them. More than ½ of the 24 terms are judged to be superfluous, and they can be rejected without loss. E. N. T.

2121. Primary factors in biostratigraphy. H. E. Wheeler. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (3), 640–55.—3-dimensional contiguous biostratigraphic units, like rock units, may be regarded as belonging to 3 conceptually distinct categories: (1) units defined essentially by position in vertical succession may include *zonule* and *zone*; (2) the term *biosome* is proposed for mutually intertongued units defined on the basis of both vertical and lateral positional relationships; and (3) *biofacies units*, which are quantitative lateral biostratigraphic variants of a stratigraphic interval.

Environmentally controlled biostratigraphic–lithostratigraphic analogies are: (1) zonule–lithostrome; (2) biosome–lithosome; (3) biofacies–lithofacies; and (4) biotope–lithotope; but evolution-controlled zones have no lithic analogy.

Faunally barren entities must be recognized in each of the biostratigraphic categories. E. N. T.

2122. Chief tool of the petroleum exploration geologist: the subsurface structural map. L. Sebring, Jr. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (3), 561–87.—This paper was prepared mainly for the inexperienced geologist who is just beginning his exploratory work. The ideas expressed are based on 10 years of exploratory work in SW. Texas, S. Louisiana, and the Denver–Julesburg basin. The writer believes that the principles of exploratory mapping that apply in these areas will also apply in other areas where sandstone production predominates.

The subsurface structural map, modified by the addition of permeability boundaries, when it is prepared and maintained by a competent geologist with a complete log file and adequate well records, will be an increasingly effective and relatively inexpensive tool for use in exploration for petroleum. Barring the discovery of a direct method of finding oil, the various subsurface methods based on well control will gradually tend to supplant all other methods as more and more wells are drilled in the never-ending search for petroleum. E. N. T.

2123. Marine Sonoprobe system, new tool for geologic mapping. C. D. McClure *et al. Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (4), 701–16.—The Marine Sonoprobe system, a low-frequency seismic system which generates a pulse of sound energy with a dominant frequency of 3800 c.p.s., is described. Marine Sonoprobe profiles are presented which illustrate various geologic features. Among these are examples of buried channels, reefs, anticlines, faults, facies changes, and sedimentary pinch-outs. Bottom-sediment sampling and coring have shown that the reflections observed on Marine Sonoprobe records are correlative with changes in sediment type. The various factors which have an effect upon the quality of the records and the depths from which reflected signals may be recorded are: (1) boat speed and course with respect to the direction of movement of waves and currents; (2) instrument installation; (3) dominant frequency, pulse shape, and pulse energy; (4) water depth; and (5) geologic conditions such as thickness and depth of the reflecting horizon, and possibly the moisture content.

Marine Sonoprobe information is most useful in a coring and sediment analysis programme. E. N. T.

2124. System in photogeology. R. R. Hartman and K. N. Isaacs. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (5), 1083–93.—In the study of features that have been modified by a succession of geologic agents or events, the simple matching of photos becomes inadequate, and the aerial photos must be studied and analysed in a systematic manner.

The method by which a photo may be described in terms of its topography, drainage and erosion, tone, and vegetative cover is described and their significance is discussed.

Land forms, and their photographic aspects, are discussed under the broad headings of sedimentary rock features, igneous rock features, metamorphic rock features, features developed on unconsolidated materials, and structurally controlled features. E. N. T.

2125. Colour aids photogeological interpretation. J. I. Gimlett and K. E. Hunter. *World Oil*, 1958, **146** (5), 123.—Aerial colour photography has recently become an economic possibility for photogeological interpretation. The study of colour transparencies has shown that differences in hue are readily apparent and lead to fine detail which cannot be seen on monochrome prints. Arid climates in particular are favourable for interpretation in colour, where formations can be traced by colour over long distances, as has been shown by recent work in S. America and the Four Corners area of the U.S.A. The colour transparencies can be used in accurate stereoscopic plotting instruments, and monochrome prints can be prepared if necessary. Colour prints are at present prohibitively expensive, and a disadvantage of the technique is the high cost of film, which is *ca* 5 times that of panchromatic film. Reproduction costs are also higher and there are narrower latitudes for exposure and developing. Total cost of aerial colour coverage is, however, only *ca* 30–50% higher than monochrome coverage, depending on local weather conditions. The film differs from the conventional colour film in that it is 4 times as fast, has better colour balance, and can be developed in field dark rooms.

C. A. F.

2126. Argillation and direct bauxitization in terms of concentrations of hydrogen and metal cations at surface of hydrolysing aluminium silicates. W. D. Keller. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (2), 233–45.—Some observations have shown that certain aluminium silicate rocks weather directly to bauxite, but other observations indicate that the same rock types weather elsewhere to kaolinite, which may then undergo weathering to bauxite (the term bauxite refers to a rock composed dominantly of hydrated aluminium oxide). These contrasting differences in initial products of weathering are explained by relating their separate origins to differences in pH at the surfaces of the parent minerals while undergoing hydrolysis. The pH at a mineral surface during hydrolysis is taken from the abrasion pH of the mineral. E. N. T.

2127. Concept of diagenesis in argillaceous sediments. R. E. Grim. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (2), 246–53.—Since the post-depositional changes of expandable clay minerals to micas in marine sediments is only partial, it seems worthwhile to examine the factors which probably determine the degree of alteration. The expandable material in such sediments has had 2 modes of origin: (1) by the degrading of micas in weathering processes, and (2) by the alteration of volcanic ash, as in bentonites. A third mode of origin by hydrothermal alteration probably is not quantitatively important. It seems likely on the basis of structural considerations that expandable material of the first category would be more easily transformed to micas than that of the latter category. It may well be that bentonite type of mont-

morillonites are not changed beyond the mixed-layer stage. So-called metabentonites provide information on this point in that they, with only one possible exception known to the writer, are mixed-layer structures. It seems quite likely that they were montmorillonites to begin with, and many are in a marine section so that their clay mineral composition is in accord with the concept of the tendency to the formation of micas in marine argillaceous sediments. The exception noted is one in which the transition to illite is nearly complete.

There is still the question of the reason why the alteration to micas and chlorite is only partial. What limits the transformation? The only suggestion that the writer can make is that it depends on the availability of potassium and magnesium. These elements are required for the transitions, and if they are not available either at the time of accumulation or later after burial in sufficient amounts for the complete transition, only partial alterations can take place. Degraded illites and chlorites, already having some of these elements, would require less amounts for the transition, which is an added reason (to the structural one) for their easier transition to definite crystallizations.

Clay mineral studies have not yet reached the point where they throw much positive light on the origin of ancient sediments, but definite progress is being made in that direction.

E. N. T.

2128. Geologic interpretation of argillaceous sediments. C. E. Weaver. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (2), 254–309.—**Pt I. Origin and significance of clay minerals in sedimentary rocks.** There is little need to point out to petroleum geologists the geologic importance of shales and clay minerals; however, it is worth noting that more than 50% of the minerals in sedimentary rocks are clay minerals, that shales comprise somewhere between 50 and 80% of the geologic section, and probably more than 95% of all sedimentary rocks contain clay minerals. It is unlikely that any geologic interpretation can approach completeness if such a large percentage of the stratigraphic section is neglected. During the past several years, from X-ray diffraction analyses of the clay in thousands of sedimentary rocks, it has been found that the clay minerals furnish much useful geologic information not otherwise obtainable.

The most common process acting on the clay minerals in marine environments is cation adsorption. The modifications produced by this process are secondary, but because of the over-emphasis of names rather than processes, they have been considered fundamental changes and the process has been called diagenesis. From the geologist's viewpoint, the basic clay mineral lattice, which is inherited from the source material, is the most significant parameter of the clay minerals, and modifications caused by the adsorbed cations are secondary, derived parameters reflecting the character of the depositional environment. This concept of dualism is essential to the understanding of clay genesis, and the significance of the 2 parameters must be understood before a genetic classification can be constructed and before clays can be used for geologic interpretation.

Pt II. Clay petrology of Upper Mississippian–Lower Pennsylvanian sediments of Central United States. Several distinct clay mineral zones can be identified in the Upper Mississippian–Lower Pennsylvanian sediments of Oklahoma. The present study summarizes the data on the identification and distribution of these zones in Oklahoma and surrounding states. With the exception of S. Oklahoma, the density of the sample control is relatively sparse, but since the clay mineral suites within these Palæozoic shale zones remain relatively constant, it is felt that the coverage is probably adequate for a preliminary investigation.

Many of the conclusions given are by no means proved. In clay petrology, as in many phases of interpretative geology, it is frequently not possible to obtain direct proofs and unique interpretations. When this is the case, the only reasonable alternative is to interpret data in a manner that is consistent with a general philosophy which, in turn, is constructed from a study of a great many similar situations. The conclusions in this example are consistent with the philosophy developed, in part, in the first section of this paper. E. N. T.

2129. Effect of source and environment on clay minerals. I. H. Milne and J. W. Earley. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (2), 328–38.—The clay mineral assemblage in an area of active deposition is dependent largely on the character of the source area. This conclusion is based on a study of the clay mineralogy of sediments of the lower Mississippi River, the active delta region, the St Bernard sub-delta, and the Mississippi Sound–Mobile Bay area. Montmorillonite, the predominant clay mineral in the Mississippi River and Delta sediments, is apparently the stable product of soil development and rock weathering in the drainage basin of the Mississippi River. The sediments of the Mississippi Sound–Mobile Bay area, E. of the Mississippi Delta and derived ultimately from the Appalachian Province, contain considerably more kaolinite. Transition zones between the 2 sediment types can be differentiated.

An examination of buried muds of Tertiary age has indicated that little or no alteration of clay minerals takes place in shales to a depth of several thousand feet. However, clay minerals contained in sands may be greatly altered during burial. E. N. T.

2130. Salt-dome breccia. P. F. Kerr and O. C. Kopp. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (3), 548–60.—The examination of polished sections of more than 100 sidewall cores from depths between 5000 and 15,000 ft in various S. Louisiana wells has indicated the presence of a broad " breccia " zone which is associated with certain salt domes. The samples examined are from the vicinity of Caillou Island, Bay de Chene, Bay St Elaine, and domes in the Lafourche basin levee district.

The breccia is considered to result from differential movement throughout a broad dome-shaped mass with the salt plug at the centre. Microscopic, megascopic, and physical studies establish the texture as an inherent feature of the shale and not an impact effect of the coring mechanism.

The breccia appears significantly different from well-known types ordinarily recognized in sediments as illustrated by sub-aerial, tectonic, glide, desiccation, and intraformational breccias. The term " salt-dome breccia " is suggested by the proximity of breccias to salt-dome areas. It appears distinct from the local breccia of the sheath.

The texture is believed to be developed by differential movement throughout the sedimentary mass. It accompanies the emplacement of the salt plug and appears in shale consisting essentially of clay-mineral aggregates. It occurs at depths where the shale is dry enough to provide adequate rigidity to register brecciation. E. N. T.

2131. Photometer method for studying quartz grain orientation. J. D. Martinez. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (3), 588–608.—A new method is described for determining the direction and relative degree of preferential quartz grain optic axis orientation in rocks principally composed of quartz. It is intended primarily as a tool in the petrofabric analysis of sandstones, but could also be used in a study of metamorphic rocks.

The technique consists of measuring by means of an attached photometer the variation in the intensity of monochromatic light passed through a standard thin section of sandstone on the stage of a petrographic microscope with gypsum plate inserted and nicols crossed during a 360° rotation of the stage. Minimum intensity of light occurs

when the trend of the optic axes of the quartz grains lies parallel with the slow direction of vibration of light in the gypsum plate. Experimental data obtained by this method have been interpreted by the writer to indicate that the trend of the long axes of the quartz grains also lies parallel with this direction for some samples.

A petrofabric study, using this method, was made of a sandstone from the Bell Canyon formation, cropping out in the vicinity of the El Capitan Reef Escarpment, near Nickel in Culberson County, Texas. The direction of *c*-axis lineation of quartz grains, generally NW.–SE., was found to correspond with the direction of alignment of oriented fusulinids and to be approximately at right angles to the trend of ripple marks also found in this formation. From this evidence, it was concluded that *c*-axis orientation determined by this method could have been safely used as evidence for deducing current directions if the other sedimentary features had not been visible. E. N. T.

2132. " Glauconite " pellets: their mineral nature and applications to stratigraphic interpretations. J. F. Burst. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (2), 310–27.—The term " glauconite " is currently being used with a dual connotation. Originally coined as a description for a blue-green micaceous mineral, this word is now widely used as a morphological term for small spherical, green, earthy pellets. By X-ray, these pellets can be grouped in 4 general mineralogical classifications, only one of which has the diffraction properties usually attributed to the mineral glauconite. These differences are not necessarily reflected in the size, shape, or colour of the pellets.

Glauconite pellets are deemed to result from a variety of origins that require the 3-layer silicate lattice, supplies of potassium and iron, and a suitable oxidn potential for transformation. Variations in these 3 fundamental requirements are believed responsible for the pellet variations. E. N. T.

2133. Sediment age determination by Rb/Sr analysis of glauconite. L. F. Herzog *et al. Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (4), 717–33.—A study has been made of the feasibility of applying the Rb/Sr method of age determination directly to sedimentary rocks through the use of the sedimentary accessory mineral glauconite. The glauconites analysed may be truly authigenic, as all the ages computed are reasonable; however, the great present imperfection of knowledge of absolute sedimentary time makes critical evaluation of such data most difficult. Further development of this method is well justified, for the demonstrated analytical feasibility of the determination of both Rb/Sr and K/A ages for glauconites and other authigenic K, Rb minerals may make possible the establishment of a dependable absolute time scale for at least the post-Precambrian sedimentary column. E. N. T.

2134. Rate of migration of petroleum by proposed mechanisms. J. G. Roof and W. M. Rutherford. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (5), 963–80.—Postulated mechanisms of petroleum accumulation have been divided into 4 categories, according to motion of the phases. These are as follows: (1) both petroleum and water phases flowing; (2) petroleum phase flowing, water phase stationary; (3) water phase flowing, petroleum phase stationary; and (4) both phases stationary. Mechanisms (3) and (4) require that petroleum migrates on a mol scale through aq soln.

A qualitative discussion of the pertinent factors involved in mechanisms (1) and (2) is presented, together with semi-quantitative estimates of rates of accumulation for mechanisms (3) and (4).

According to these estimates, accumulation of petroleum by mechanisms (3) and (4) would be rather slow, and migration would be only in an upward direction. In addition, it is evident that considerable fractionation of petroleum would take place during migration. E. N. T.

2135. Carbon isotopic compositions of petroleums and other sedimentary organic materials. S. R. Silverman and S. Epstein. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (5), 998–1012.—The C-13/C-12 ratio of the aromatic-enriched fraction of a petroleum does not differ by more than one per ml from the ratio of the paraffinic–naphthenic fraction. This indicates that changes in chemical composition alone are not responsible for the 10-per-ml range of isotopic composition noted for petroleums. Natural gases from petroliferous areas have considerably lower C-13/C-12 ratios than associated petroleums. In view of the narrow range of isotopic composition in petroleums, gas formation does not appear to be an important natural mechanism for depleting oilfields. The isotope ratios of organic carbon in ancient sediments fall within the isotope ratio range of petroleums. E. N. T.

2136. Cold- and deep-water coral banks. C. Teichert. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (5), 1064–82.—Attention is called to rich coral banks and patches in the N. Atlantic Ocean and along the coast of Norway at depths generally below 300 ft and in water temp down to 4° C. The framework of these banks is supplied by a few species of corals and hydrozoans. The associated fauna consists of nearly 200 species of invertebrates, of which more than 100 are potential fossils. Considered as geological bodies these banks and patches form " organic reefs " (bioherms biostromes) up to 200 ft thick and up to 1¼ sq. miles large. It is suggested that environmental interpretation of ancient biohermal and biostromal deposits may be improved by paying close attention to the known facts of the distribution of calcareous algæ and of hermatypic and ahermatypic corals and to the proportions in which these groups of organisms are associated. A few randomly selected examples of fossil " reefs " and bioherms are discussed in the light of the foregoing observations. E. N. T.

2137. Comanchean stratigraphy of Kent Quadrangle, Trans-Pecos, Texas. J. P. Brand and R. K. Deford. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (2), 371–86.—At the N. end of the Coahuila platform, the thinned Comanchean sequence consists of the newly named Sixshooter group of carbonate formations underlain by the newly named Yearwood formation. The Sixshooter group consists, in descending order, of the Buda limestone, the newly named Boracho limestone composed of the newly named San Martine and Levinson members, and the Finlay limestone at the base. Beneath the Finlay is the Cox sandstone, and beneath the Cox, the Yearwood formation, which consists of an upper limestone member previously called Rustler (Permian) and a basal conglomeratic sandstone member that rests unconformably on Permian formations. The Buda and Boracho are biostratigraphically correlative with the Washita group of Central Texas; similarly, the basal part of the Levinson member and all the Finlay limestone are correlative with Fredericksburg formations. Whether any part of the Cox sandstone is contemporaneous with the Trinity groups is speculative. The Yearwood is probably a Trinity, though possibly a Fredericksburg, correlative. E. N. T.

2138. Pennsylvanian subsurface geology of Sutton and Schleicher Counties, Texas. R. W. Rall and E. P. Rall. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (4), 839–70.—Pennsylvanian and Lower Permian deposition in the Sutton–Schleicher area was controlled largely by the Concho arch on the E., the Midland basin on the W., and the Val Verde basin on the S. The oldest Pennsylvanian rocks are limestones and dark shales of Bend age, which are confined to depressions of tectonic and physiographic origin and are thickest in grabens belonging to the Fort Chadbourne fault system. Lower

Strawn limestones continued to fill the depressions, gradually spreading out until by middle Strawn time the highest features had been covered, though local movement along the Fort Chadbourne faults continued throughout the Pennsylvanian period. 4 distinct sedimentary facies of the upper Strawn are recognized. E. N. T.

2139. Gulf Coast tectonics. M. Bornhauser. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (2), 339–70.—The present paper summarizes the result of a regional and local structural study of the W. Gulf Coast (including Mississippi, S. Arkansas, Louisiana, and E. and S. Texas) and the adjoining continental shelf area of the Gulf of Mexico.

The ultimate goal of the study was to learn when and where oil and gas migrated into the local Gulf Coast structures. To reach this goal, an understanding of the structural history of the area was considered an essential requirement, including a knowledge of the various types of local and regional structures present. The establishment of these structural types, their genesis, and genetic relation was therefore regarded as the first step of the study. This study deals primarily with the results and conclusions of this initial investigation which, being a subsurface investigation, depended mainly on information and data from boreholes. E. N. T.

2140. Citronelle age problem. J. A. Doering. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (4), 764–86.—The Citronelle formation of the Gulf Coast region has been considered, on the evidence of fossil plants, to be late Pliocene in age, but some geologists have thought that it may be basal Pleistocene because of its unconformable relations with the underlying Tertiary formations and its close associations with the overlying Pleistocene formations. In this paper it is shown that the fossil evidence supports no more than a pre-Nebraskan determination, thus making an early Pleistocene correlation as plausible as one of late Pliocene. E. N. T.

2141. Stratigraphy of some Lower Cretaceous rocks of Black Hills area. H. Skolnick. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (4), 787–815.—The Skull Creek shale, the Newcastle sandstone, and the lower part of the Mowry shale are considered to be Lower Cretaceous in age correlated by foraminifera with rocks of Kansas, Oklahoma, and Texas. E. N. T.

2142. Arkansas Valley region develops new gas reserves. W. M. Caplan. *World Oil*, 1958, **146** (6), 101.—There are 38 gas fields in the Arkansas Valley in the N. part of the state, and an analysis of the geology of the area shows that its future possibilities for further gas, and possibly oil, fields are excellent. It is a synclinorium situated between the Ozark dome and the Ouachita Mountains, and beds range from Cambrian to Pennsylvanian. The stratigraphy is locally complex, with SE. thickening and facies changes. Possibilities exist for stratigraphic traps, where limestones are truncated by the Chattanooga shale, as well as for structural and other types of stratigraphic traps. The Pennsylvanian Atoka is the main producing formation, and accumulations can be related directly to structure. Anticlinal axes trend approx E.–W. across the basin, and there is faulting which is difficult to map because of poor control at depth. C. A. F.

2143. Upper Ordovician stratigraphy in Eastern Interior region. A. M. Gutstad. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (3), 513–47.—The Eastern Interior region is herein defined as the area bounded by the Wisconsin arch and Michigan basin on the N., the Cincinnati arch on the SE., and Ozark dome on the SW. It includes the states of Illinois and Indiana, and parts of Iowa, Ohio, Kentucky, and Missouri.

The name Cincinnatian Series, a time-stratigraphic term, is restricted to rocks of Late Ordovician age, wherever they occur. Most of the "formations" assigned to the Cincinnatian Series are actually biostratigraphic zones. The name Cincinnati group is revived for the body of rocks continuous with the type Cincinnatian Series in the Cincinnati arch region, without time connotation. The Cincinnati group in subsurface is composed, in descending order, of the Maysville–Richmond formation and the Eden shale.

Upper Ordovician rocks in W. Indiana and E. and S. Illinois are assigned to the Maquoketa group, composed, in descending order, of the Orchard Creek shale, Cape limestone, and Eden shale. Upper Ordovician rocks in NW. Illinois and E. Iowa are assigned to the Maquoketa shale. E. N. T.

2144. Stratigraphic analysis of Silurian rocks in Michigan basin. W. N. Melhorn. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (4), 816–38.—Samples from 35 exploratory wells penetrating a complete section of Silurian rocks in the Michigan basin have been analysed by conventional quantitative chemical methods. Chemical analysis yields numerical lithologic data not available from study of published subsurface information. The numerical lithologic data are used to construct clastic ratio, sand–shale ratio, evaporite ratio, and isopach maps which depict gross aspects of Silurian sedimentation, history, and environmental tectonics of the basin. E. N. T.

2145. Bituminous and other organic substances in pre-Cambrian of Minnesota. F. M. Swain, A. Blumentals, and N. Prokopovich. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (1), 173–89.—A preliminary examination has been made of the bituminous and other organic substances in several argillaceous rock formations of the Minnesota pre-Cambrian. As used here, bitumens are those substances in the rock that are soluble in benzene, and include hydrocarbons, asphaltenes, resins, together with some of the pigments, carbohydrates, and other organic cpds, as well as small amounts of mineral substances such as sulphur. In recent sediments, the term lipoids may be used for the benzene-soluble materials which include not only lipoids or fats, but the bituminous components as well.

Early pre-Cambrian (Knife Lake) Thomson slate yielded approx 200 p.p.m. of bitumens, nearly all of which is in the form of colourless oil, possibly consisting of hydrocarbons. Later pre-Cambrian (Animikie) Rove argillite contains 180 p.p.m. of bitumens, which in large part remain adsorbed on alumina in chromatography and are mainly non-hydrocarbons; Rove graywacke, however, yielded 450 p.p.m. of bitumens, possibly including hydrocarbons. Animikian Cuyuna ferruginous and manganiferous argillite has 380 p.p.m. of bitumens, low in presumed hydrocarbons and with more asphaltenes than the other samples. Elemental sulphur was present in one of the Cuyuna chromatographic fractions, but was not detected in the other samples. E. N. T.

2146. Chester cross-bedding and sandstone trends in Illinois basin. P. E. Potter *et al. Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (5), 1013–46.—The purpose of this study is to relate directional properties studied in outcrop to subsurface facies maps. Until very recently, each line of endeavour generally has been studied separately. It is believed that linking directional properties to stratigraphic variability can significantly expand the geologist's knowledge of depositional pattern and source location, and thus enhance his ability to predict sedimentary trends of economic importance.

Primarily, the purpose is to seek the relation between Chester cross-bedding and sandstone trends. E. N. T.

2147. Geology and exploration in the Four Corners. B. F. Gray. *World Oil*, 1958, **146** (5), 130.—Increased costs of finding oil in the U.S.A. have led to increased interest in the Four Corners area, in the common corner of Colorado, Utah, Arizona, and New Mexico. In this area oil has been found

and is being produced from relatively shallow depths at reasonable cost. 3 basins occur within the area: the San Juan, Paradox, and Black Mesa basins. Oil possibilities of each of these are discussed. In the San Juan basin large gas reserves have been found, and oil production from stratigraphic traps has become important in recent years. 3 important fields are Verde–Gallup, found in 1955, producing from the Cretaceous Mesaverde; Bisti, 1955, also producing from the Mesaverde; and Doswell–Lowry, 1951, producing from Cretaceous Mancos. There are excellent prospects for stratigraphic traps in the basin.

In the Paradox basin, where there is Palæozoic production, there are many salt anticlines whose flanks have possibilities. Possibilities of Mississippian and Devonian production should be good if pre-Pennsylvanian structures can be found.

In the Black Mesa basin there are many large undrilled anticlines and marine Palæozoic beds are known. The area is very attractive for exploration. Diagrams give the geological section and fields of the Paradox and San Juan basins. 5 refs.

C. A. F.

2148. Deeper possibilities of the Paradox studied. C. A. Moritz. *World Oil*, 1958, **146** (5), 136.—The discovery of Mississippian oil at Big Flat in Grand County, Utah, in 1957 has emphasized the importance of the pre-Pennsylvanian rocks which are largely untested in the Paradox basin. These deep possibilities are in Mississippian carbonate reservoirs, Devonian carbonates and sandstones, and the Cambrian, where several shows have been found. Drilling costs of deep wells may limit drilling temporarily, as the area is remote and transport costs are high. It is thought that Mississippian wells in the more accessible parts of the basin could be completed for *ca* $200,000.

Maps show the geology of the basin. 7 refs. C. A. F.

2149. Tertiary stratigraphic units of Western Mojave Desert, California. T. W. Dibblee, Jr. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (1), 135–44.—Scattered throughout the W. Mojave Desert, mostly in the vicinities of Rosamond, Mojave, and Boron, are exposures of non-marine sedimentary and volcanic rocks of Tertiary age. These rocks rest on a deeply eroded surface of pre-Tertiary granitic and metamorphic rocks that form the crystalline basement complex of this region, and are overlain unconformably by alluvial sediments of Quaternary age. Where exposed, the Tertiary rocks are moderately deformed and much eroded.

With the exception of exposures in the foothills NW. of Mojave, the rocks of Tertiary age are mapped as a group, named the Tropico group, with a max exposed thickness of *ca* 2800 ft. This group is divided into several lithologic units of local extent. E. N. T.

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The data indicate that the pheophytin content of sediments is almost independent of the production rate of chlorophyll-containing plankton and of dilution with sediments—other than coarse-grained turbidity-current deposits. Instead, the chief factor controlling its abundance appears to be the amount of decomposition undergone in settling through the water column and before burial in the sediment. The decomposition is controlled primarily by water depth, oxygen content of the water, and bottom topography.

The chlorophyll derivatives found in sediments are intermediate in structure between chlorophyll and the porphyrins found in petroleum. Magnesium has been lost, but vanadium and nickel have not yet been introduced into the pigments. Further changes in the organic structure which must occur to convert these pigments into those found in petroleum involve simple reactions such as reduction of carbonyl groups, hydrogenation of carbon–carbon double bonds, dehydrogenation, and decarboxylation. All of these changes may be expected to occur gradually in the sedimentary environment.

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Oil accumulation in this type of trap may be affected by a number of variables, including sedimentation, dip of strata, rate of truncation, distribution of seal, and salinity of water. An attempt is made to analyse these variables to determine their individual effect on oil accumulation. E. N. T.

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Faulting in the Avonlea area is believed to be of tectonic origin, caused by recurrent adjustments along pre-Cambrian faults. This concept does not exclude possible minor faulting due to salt collapse after deposition of the Middle Devonian Prairie evaporites.

Oil and gas accumulations in fault traps in pre-Middle Devonian rocks are therefore possible, although it has to be kept in mind that displacement in pre-Mississippian rocks may not be so great as in the younger strata. E. N. T.

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The writer has studied 3 important productive reef areas of Central Alberta: Leduc, Stettler, and Redwater. In the Leduc and Stettler areas the Leduc reef formation is completely dolomitized and the original lithologic texture and organic structures are largely destroyed or obscured by recrystallization. Thus, the various lithofacies and biofacies recognized in relatively pure limestone reefs, such as Redwater, are mainly obscured in completely dolomitized reefs. However, vestiges of original limestone character were ob-

served and recorded for later interpretation of the secondary dolomites.

In each area details of the stratigraphy of reef carbonates and associated deposits are described as a background for the succeeding historical interpretation of reef growth. E. N. T.

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Hassi Messaoud has an estimated probable recoverable reserve of *ca* 4,160,000,000 brl, and intensive development is planned. Several wells have been completed, with production from Palæozoic sandstones at *ca* 11,000 ft. The structure is large and flat, and the field was found by drilling on a seismic refraction anomaly. C. A. F.

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A series of examples of resistivity surveys is described. There are 3-layer problems involving faulting and gentle arching.

With modern equipment 2 or 3 electrical soundings can be made per week on lines of current flow of up to 20–25 km. The interval between the soundings depends on the depth of investigation. On lines of 5–10 km, the stations may be at 1–2-km spacing; on lines of 25 km, at 4-km intervals. In France 40 km. of profile can be covered per month at a cost of *ca* 100,000 fr./km. G. D. H.

2161. Use and advantages of modern magnetic recording techniques in seismic reflection work. M. Rimbaut. *Bull. Ass. franç. Tech. Pétrole*, July 1958, 357–80.—Magnetic recording of seismic reflection impulses offers various advantages in processing and interpretation. Various filters can be applied; corrections can be incorporated; mixing and additions are possible; the results can be presented in various forms, including variable density on films.

The advantages from an interpretative angle are discussed, with the aid of various records. Reference is made to the V.C.A. epidiascopic projection system, which permits the toning down of certain arrivals, thereby making the film more readable. In most areas magnetic recording offers worthwhile advantages over the classic system. G. D. H.

2162. Chart migration analysed. F. A. Roberts. *World Oil*, 1958, **146** (6), 108.—The uses and limitations of published migration charts are analysed. These are used for seismic work to determine dip, depth, and offset of reflecting horizons, and it is shown that results vary slightly if average velocities are used with straight-line paths and instantaneous velocities with curved-ray paths. Either straight- or curved-ray paths must be assumed. It is concluded that the wave front-ray path chart is the best for rapid use, but a separate chart is needed for each change in velocity. The sine–cosine chart needs more computing and plotting time. Diagrams of different types of chart are included. 6 refs. C. A. F.

2163. Grouping of receivers (geophones) as a way of improving results of seismic surveys. H. Banas. *Nafta (Krakow)*, 1957, **13**, 325–30.—After reviewing the basic principles of differential selection of signals by appropriate placing of receivers as practised in the U.S.A. and the U.S.S.R., the author analyses the effects of directional selection and mixing, by feeding of *ca* 25% of signal from one to another of the circuits, on the summary picture received. The 2 methods reinforce each other in considerably reducing the unwanted signals, which are separated by a phase difference, and therefore may be made to interfere, whilst the "coherent" reflected waves add arithmetically. The irregular harmful waves can be eliminated in due course by finding out whether their sum is proportional to $\sqrt{(n)}$, where (n) = number of receivers. On the other hand, if the distance between receivers is more than 8 m, the unwanted signals do not add up at all. Experimental work done in the Glowaczow region, Ostrzeszow, Chelm Lubelski, and Swidwin, as well as in the vicinity of the Konrad coal mine (Grodzisko basin), has allowed the identification of unwanted waves and provided practical experience for crews, as well as guidance for the scientific staff in correct interpretation of results. The method promises to be of great help in the investigation of the NW. sedimentation area. M. S.

2164. Conditions of use of the airborne magnetometer in oil search. R. Giret. *Bull Ass. franç. Tech. Pétrole*, May 1958, 237–46.—The airborne magnetometer gives a continuous profile of the magnetic intensity along the line of flight. Variations of 1–2 γ can be detected, and flights 100 m or more above the surface eliminate various local effects. Regional effects and more local anomalies can be observed; these are mainly due to the basement and also to basic volcanics and intrusives. Changes in basement depth play a part. Many anomalies are of a few tens of γ in the regional field of 30,000–60,000 γ. Profiles and isogam maps display the results. There are several methods of interpretation. Theoretically there is an infinite number of possible solutions, but geological considerations may greatly reduce the possibilities. Aerial photographs may aid by showing faults. Structural and depth indications are possible. Salt domes have been shown by very feeble negative anomalies. Depths may be correct to $\pm 25\%$.

Widespread profiles can show the presence or absence of sedimentary basins; closer profiles show the trends of anomalies; networks give isogam maps. An interval of $\frac{1}{2}$ the depth of the anomaly is needed to correlate profiles unambiguously; even closer spacing may be needed when great depth gives feeble anomalies. 1–2 km spacing may be employed. G. D. H.

2165. The seismic magnetic integrater. E. G. Schempf and K. A. Robertson. *World Petrol.*, 1958, **29** (3), 56.—Magnetic tape recording in seismic work is used almost entirely for data presentation and preservation, but recently a new method of magnetic recording has been introduced to eliminate extraneous energy from seismic records in areas where seismic exploration has been largely unsuccessful. This energy is usually caused by waves travelling horizontally, and can render seismograms useless. Filters and the use of multiple geophones laid out in pre-determined patterns can improve the quality of the records, but they have disadvantages. By using a magnetic recorder together with a set of seismic instruments it is possible to integrate the energy from successive shots in a borehole. The reflected energy is summated and the noise cancelled, leaving reflections which can be picked up. C. A. F.

2166. Subsurex—a new approach to geophysical exploration using sonic frequencies. L. R. Padberg. *World Petrol.*, 1958, **29** (3), 60.—Subsurface exploration using highly repetitive sound sources, similar to echo-sounding, has been successful in recording the form of the sea floor and the sediments beneath down to several thousand ft. Penetration depends on the nature of the sediments and the sonic frequencies used. True profiles are obtained, as there is continuous transmission and reception. The survey boat moves at *ca* 600 ft/min, and very high power is used at low frequencies.

The success of the sonic system depends much on the sound projector, and experiments have been carried out on several unconventional sound generating methods. These include powerful underwater electric sparks, and compact high-level, low-frequency sound sources which can be used to replace explosives in seismic work. C. A. F.

2167. Magnetic record analyser. E. B. Tickell. *World Petrol.*, 1958, **29** (3), 64.—The Clevite magnetic record analyser, for use in seismic work, is described. It is an all-electronic continuous computing machine, basically designed to make fixed corrections and remove normal step-out from seismic records. It operates automatically, but manual operation is also provided. In playback an oscillograph is controlled by a timing system so that paper records are started and stopped automatically at the correct time.

The analyser is housed in 3 pairs of cabinets for convenient packaging. The mechanism is contained in 5 ranks of electronic equipment and one section with 4 tape drums. It is divided into working sections consisting of data input, computing, and data output. C. A. F.

2168. Environmental studies of carboniferous sediments. Pt II. Application of geochemical criteria. E. T. Degens *et al.* *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (5), 981–97.—Investigation shows that the fresh water or marine character of sedimentary rocks can be determined by geochemical

criteria. An environmental diagram using boron, gallium, and rubidium abundances as variables shows some overlap of data for fresh water and marine rocks, but a zone of overlap can be defined by straight lines so that 80% of a group of Pennsylvanian shales and limestones are classified in accord with the evidence of diagnostic fossils. The same criteria, applied to sandstones and underclays of the Allegheny series, yield environmental conclusions in general agreement with stratigraphic and petrographic evidence. It appears likely that trace element studies will be found to be generally useful in stratigraphy and palæogeography, by facilitating the environmental determination of non-fossiliferous rocks.

E. N. T.

2169. Thorium-to-uranium ratios as indicators of sedimentary processes: example of concept of geochemical facies. J. A. S. Adams and C. E. Weaver. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (2), 387–430.—Because of analytical difficulties, few data are available on the thorium and uranium contents of sedimentary rocks. More than 200 new thorium and uranium determinations have been made by a γ-ray spectral technique and by an α activity–fluorometric uranium technique. Together, these 2 independent techniques can be used as an experimental test of secular radioactive equilibrium. Only rarely in this study have fresh samples of ancient sedimentary rocks been found out of radioactive equilibrium. The accuracy of the thorium-to-uranium ratio determinations is more than sufficient for many geologic studies.

Field tests indicate that quantitative potassium, uranium, and thorium determinations can be made with a spectral γ-ray logging instrument. Logs obtained with such instruments may provide an important additional means for subsurface interpretations. E. N. T.

2170. New developments in radioactive well-logging research. R. L. Caldwell and R. F. Sippel. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (1), 159–72.—This paper describes lab experiments on the interactions of neutrons and γ-rays with common earth elements, sedimentary rocks, and the fluids found in these rocks and in the borehole. The results show that a number of common earth elements can be identified by the γ-rays produced when rocks are bombarded with high-energy neutrons. The density of formations, of borehole fluids in producing wells, and of cement behind steel pipe can be measured by the use of a collimated source of γ-rays and a scintillation-crystal detector.

These results, supported by preliminary field tests, show that new methods of radioactive logging of both old and new wells are useful for defining zones of oil, gas, and water saturation; for identifying various lithologic types; for shutting off water zones in the reworking of old wells; and for recovering steel pipe when wells are abandoned. E. N. T.

DRILLING

2171. Shell cuts drilling costs. T. W. G. Richardson. *World Oil*, 1958, **146** (5), 175.—The use of air and aerated mud in drilling a well in Kentucky has resulted in estimated savings of $98,000, mainly due to reduced rig time and fewer bits. The well was selected for testing because of the very hard formations to be drilled and the probability of lost circulation if mud was used. The air compressor equipment was in 3 stages designed for heavy duty, and a diagram shows the layout. A summary of the drilling history is given, with charts, and it is concluded that in hard formations of the type experienced air drilling improves bit life and penetration rate. In the test well max drilling rate was reached whilst drilling dry formations, and was *ca* 4 times faster than with mud in comparable conditions. C. A. F.

2172. Continuous velocity logging techniques and applications. L. Louis. *Bull. Ass. franç. Tech. Pétrole*, May 1958, 279–91.—The logging device, *ca* 3·5 m long, has a magnetostriction impulse generator acoustically separated a distance of 1·8 m from a crystal receiver, and is run on a 6-conductor cable. Interval velocities and an integrated time–depth curve are recorded, at logging speeds of 5–30 m/min. Corrections must be applied for wave travel through the mud to the well walls.

Checks on the integrated curve can be made by firing surface shots with a geophone at known levels in the well. Caving affects the corrections, but the sonde may commonly touch the well wall.

Geophysical applications indicate points where seismic waves may be refracted or reflected. The logs can be used for geological correlation sometimes when other methods fail. For a bed of constant porosity and composition there is the possibility of detecting changes in the nature of the fluid content. Other applications are in the preparation of synthetic reflection records, which may help in interpretation, and in depth determinations in refraction work. G. D. H.

2173. Gamma ray density meter improves oil well cementing. J. P. Moran and D. G. Hartweg. *Petrol. Engr*, 1958, **30** (5), B40–5.—A sensitive continuous density recording instrument has been developed to improve density control of cement slurries in cementing operations. It is desirable to keep the cement–water ratio at the optimum value to avoid harmful effects, such as reduced strength, voidage, channelling, plug flow, and brittleness. A. E. R.

2174. Floating mud cap speeds drilling in thief zones. R. R. Lewis. *Drilling*, June 1958, **19** (8), 107–8.—Difficult drilling conditions in the Ghawar field, Saudi Arabia, call for a special drilling fluid programme. Porous limestones from below the surface to 2000 ft are drilled with water. From 2000 to 4000 ft there are shales, poorly consolidated fine sandstones, and porous to cavernous limestones. For this section a mud is required which has low water loss to prevent sloughing of the shale, low visc and gel strength to permit fast sand settling at the surface, ability to tolerate copious dilution with water for density control without large filter loss, and high response to chemical thinners. These requirements are met by using 15 lb bentonite, 4 lb starch, 0·1 lb quebracho, and 0·2 lb NaOH per brl, giving a density of 8·8–9·6 lb/gal, visc 35 sec API, filter loss 3–15 cc API, and pH 8. Additional NaOH is added to control fermentation as necessary. Lost circulation in the limestone is sometimes combated by a floating mud cap technique. Water is pumped down the drill pipe at a rate which balances the loss. Cuttings are flushed into the thief zone while the annulus remains full of high density mud, maintained by pumping *ca* 8 brl/hr mud down the annulus. After setting casing at *ca* 400 ft, mud is displaced by water for drilling the remaining 2500 ft of limestone, while the mud is converted to a high pH lime-treated emulsion type weighted with barytes to give 200 p.s.i. overbalance over formation pressure. This is used to drill the cement plug of the fourth casing string, the anhydrite cap rock, and into the pay zone. J. C. M. T.

2175. Drill pipe rotation reduces pressure drop. H. Ferrell, E. C. Fitch, and J. H. Boggs. *World Oil*, 1958, **146** (5), 158.—Increased drilling depths have involved circulation problems, and one of the most important is the power requirement of the circulation system. Much work has been carried out on hydraulic losses, but the effect of pipe rotation on these losses has often been overlooked. Experiments have therefore been carried out to study the pressure loss characteristics of flow in a rotating pipe, using a test section of 2-inch tubing which could be rotated. Data were obtained by making differential static pressure measurements across the section, which was rotated at different angular velocities for various

flow rates. Results of the tests are shown in a series of charts, and it is indicated that, if the rotary speed was increased to over 100 rev/min, there would be a net power saving.

C. A. F.

2176. Higher strength casing for bottom-hole pressures of 15,000 p.s.i. S. H. Reynolds. *World Oil*, 1958, **146** (5), 153.—A new casing has been developed with a minimum yield strength of 15,000 p.s.i. This permits larger production strings to be set, and it can withstand the higher pressures and stresses which are met in deep wells. Tables give the tentative performance properties for use in designing strings of this casing and the minimum collapse resistance under axial tension stress used in multiple weight casing string designs.

C. A. F.

2177. Fire-drilling experiments. Anon. *Oil Gas J.*, 26.5.58, **56** (21), 106.—*Tekhnika Molodezhy* reports that since 1951 the Mining Inst. of Moscow has been studying drilling methods based on the application of heat. One device developed burns a mixture of kerosine and oxygen in a water-cooled combustion chamber. The products, at 20–25 atm and *ca* 3500° C, issue downwards through a jet nozzle. No mud is used. Fracture due to uneven expansion, melting, and "burning" are the processes by which rock is penetrated. For a 200–250-mm dia hole in hard rock penetration rate is claimed to be 4 m/hr against 20 cm/hr using conventional equipment.

J. C. M. T.

2178. Drilling with surfactant muds. R. B. Hyde and J. M. McCaskill. *World Oil*, 1958, **146** (6), 117.—Surfactant drilling muds, originally developed for high-temp stability, have proved to be very useful in resisting build-up of solids, and their visc, gel strength, and fluid loss properties can be maintained under difficult drilling conditions.

Basic components of the muds are a non-ionic surfactant mixture, an electrolyte, and a polyanionic fluid loss control agent, the mixture consisting of a primary surfactant, defoamant, and emulsifier. There are 4 types of mud: (1) calcium surfactant mud, useful in problems of heaving shale and where stability in deep drilling is required; (2) low sodium surfactant muds, particularly useful for drilling in temp above 325° F; (3) sea-water surfactant muds, for drilling through mud-forming shales in offshore work; and (4) saturated salt surfactant muds, for use where salt beds are to be drilled.

The preparation and maintenance of each of these are noted, and case histories of 5 wells are briefly given. 4 refs.

C. A. F.

2179. Mud reclamation is found successful. D. M. Jeffus and V. T. Jones. *World Oil*, 1958, **146** (5), 165.—A mud reclamation scheme in the Timbalier Bay field of S. Louisiana gave a total net saving of over $800,000 in less than 18 months during the development of the field. Several types of mud were tried out, *e.g.* sea water lime, fresh water red, $CaCl_2$, and sea water CMC muds. The latter has proved the most satisfactory and is now used in most wells drilled to below 6000 ft. This requires much dilution to give a low-solids content and, in order to reduce costs, the mud-reclamation scheme was introduced. Details of the system are given and advantages and disadvantages listed. Main advantages are: (1) salvage of useful mud; (2) reduction in rig time; (3) readily available supply of mud; and (4) general reduction of mud and chemical costs. Disadvantages include: (1) increased investment; (2) restriction to one mud type; and (3) increased personnel. The economics of the system are outlined.

C. A. F.

2180. Russia tests wireline electro-drill; compares favourably with turbo-drill. A. A. Minin and K. A. Chefranov. *World Oil*, 1958, **146** (6), 124.—Research in Russia on the wireline electro-drill is reported to have been successful, with a 40–50% increase in penetration rate. In this method the bit is rotated by an electric motor and the whole assembly is carried on a wireline suspended from an electric swivel. A mud pump is fitted in the drilling unit, and this circulates the mud whilst in the hole, the mud supply being stored in the unit until drilling starts. Cuttings are removed, or the bit changed, by raising the unit and discharging it at the surface. All drilling operations can be carried out from a single control panel. In the experimental model the drilling unit was 8-13 inches dia and bit dia was 9¾ inches. Rotation averaged 500–600 rev/min. Results of tests of the equipment are given in tables, and diagrams of the mechanism are included.

C. A. F.

2181. Exploratory drilling in 1957 (U.S.A., Canada, and Alaska). B. W. Blanpied *et al. Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (6), 1125–444.—This is the 13th annual report on data gathered and compiled by the U.S. Cttee on Statistics of Exploratory Drilling. It shows that during 1957 a total of 14,707 exploratory holes were drilled in the U.S.A. and Alaska. Of these 8014 were new field wildcats, 3476 were new pool tests (including new pool wildcats, deeper pool tests, and shallower pool tests), and 3217 were outposts. Among the new field wildcats, 872 were successful; among the new pool tests, 854 were successful; and among the outposts, 1084 were successful.

The total exploratory footage drilled in the U.S.A. and Alaska in 1957 was 69,136,226 ft in the 14,707 holes, or 4701 ft/hole. These figures compare with 73,981,176 ft drilled in 16,173 exploratory holes, with an average depth of 4574 ft in 1956. Oil production had been found in the state of Washington and in Alaska for the first time.

In W. Canada, in 1957, a total of 3001 exploratory and development wells were completed; 48% in Alberta, 41% in Saskatchewan, 7% in Manitoba, 3% in British Columbia, and less than 1% in the Territories. This represents a decrease of 281 holes, or 9% compared with 1956. Exploratory drilling, however, increased by 18% (1058 wells in 1957, 899 in 1956); the overall drop was due to an 18% decrease in development holes, comprising 65% of the total. This lag in development drilling, however, was evident in only 2 provinces, Alberta (down 36%) and Manitoba (down 29%); Saskatchewan showed an increase of 16%, while the comparatively few completions in British Columbia, where a small increase was noted, and the Territories had little effect on the total.

The rise in exploratory activity involved substantial increases in all provinces except Saskatchewan, where a negligible decline took place. Alberta was up 20% (573 from 478), Manitoba 70% (75 from 44); British Columbia more than doubled its 1956 total with 61 completions. 4 exploratory tests were drilled in the Territories, one more than in 1956.

Alberta again accounted for the bulk of exploratory drilling, 54% of the W. Canada total. Saskatchewan was next with 32%, Manitoba recorded 7%, British Columbia 6%, and the Territories less than 1%. This year, for the first time, Saskatchewan led Alberta in development activity, 882 completions to 877. These 2 provinces accounted for 91% of the W. Canada development total.

In E. Canada, both development and exploratory drilling remained about the same as in 1956. Production of oil increased 5% over the previous year to 627,000 brl, and natural gas increased 11%, totalling 14,440,000 M.c.f. There were 3 significant discoveries, all in Kent County. A notable trend in SW. Ontario was the issuing of permits exceeding 1,000,000 acres of offshore acreage on Lake Erie.

In the St Lawrence Lowlands of Quebec exploratory drilling increased 54% over 1956, and what appears to be a one-well

gas pool was discovered in the Trenton rocks of Ordovician age, 20 miles NE. of the city of Three Rivers.

In Alaska there was considerably increased interest in the N. and central provinces as well as the S. province during 1957.

Some 31 separate papers give detailed data on the 1957 operations in each of the major oil-producing areas of N. America. E. N. T.

2182. Exploratory objectives of the Mogilno 1 drill hole. A. Tokarski. *Nafta (Krakow)*, 1958, **14**, 4–12.—The drill hole is located at the centre of a line crossing the Mogilno area in Kuyavy (Kujawy), and its role is connected with the second phase of the search for oil and gas in Polish Zechstein formation. The first phase was finished when Swidwin 2 was completed at 2352·1 m. As the result of this the ideas about the geology of the Polish Zechstein have become crystallized, further questions have been posed, and second stage could begin. The author gives a description of Central European Zechstein formation and its emergence in Poland, where the cyclic nature of sediments appears to have gaps. Several likely productive formations have been penetrated and identified, leading to a more complete mapping of the geological features of the Maritime (Pomorze) and Kuyavy areas. Apart from several minerals, liq bitumens have been encountered repeatedly but in minute quantities. An incomplete as yet, but comprehensive in outline, description of the geology of this promising area is given with the aid of several maps and sectional diagrams. Judging by the repeated occurrence of Na and K chlorides, crude or gas is very likely to be found here too. M. S.

PRODUCTION

2183. New repressuring method promises to triple output. C. Schnake. *World Oil*, 1958, **146** (5), 201.—2 secondary recovery projects, one in California, and the other in New Mexico, are being carried out with miscible-phase displacement, which uses a liquified petroleum gas to mix with the crude oil. It is hoped that these will increase recovery threefold. In the Newhall Potrero project propane is being injected. Oil in place is estimated at one million brl, of which 650,000 brl should be recovered. In the Bisti project in New Mexico, oil in place is estimated at 100 million brl in the Lower Gallup pool. A combination of LPG and dry-gas injection is being used, a slug of LPG preceding the dry-gas. C. A. F.

2184. Economic viewpoints in planning and executing secondary oil recovery measures. (In German.) S. Logigan. *Erdöl u. Kohle*, 1957, **10**, 425–8, 496–500.—Pt 1. Development and fundamental problems. Pt 2. Preparing and executing secondary programmes.—Pt 1. From 1925 to 1938, in the U.S.A. secondary oil production rose from 1 to 20 million tons. A Bureau of Mines report states that there were *ca* 2400 secondary programmes in operation in the U.S.A., yielding 70 million tons of petroleum, or *ca* 21% of the total annual production. The enormous increase in recent years in production in the U.S.S.R. and Rumania is attributed to secondary methods. Expectations generally are exceeded, only *ca* 10–15% of the U.S. programmes proved failures, in that the amount of oil recovered was below expectations. However, 70% of all hitherto closed secondary projects, in contrast with primary yields, have proved unprofitable, through undervaluing operative economic factors. Pt 2. Leading preparation and execution features of secondary programmes are treated. Results of secondary programmes can be determined in advance only when the prognosis of secondary in contrast with primary production, its development and operating costs, can be estimated. Strict control of progress of the operation is essential to facilitate necessary adjustments. Thorough investigation of the influence of economic factors, wages, material, and energy costs, also oil price and the practicability of executing a secondary programme must be investigated thoroughly to limit error sources and enhance the certainty of success. R. T.

2185. Analysis of pressure build-up curve in a closed oil well. W. Schiller. *Nafta (Krakow)*, 1958, **14**, 14–17.—All available diagrams indicating rise of pressure are always given with cautionary notes on their applicability. For this reason measuring test production gives a much safer method of arriving at the right figure. The author, basing his paper on American, German, and Russian sources, describes the method. M. S.

2186. Crude oil displacement by gas within the critical range. W. Dubis. *Nafta (Krakow)*, 1957, **13**, 343–4.—It is possible to choose gases to effect the displacement, so that with crude at the formation temp and pressure they will form a "critical" mixture, when capillary forces will fall and effectiveness of displacement increase. The results can be pictured on a triangular diagram with CH_4, C_2–C_6, and C_{7+} at its corners. 3 methods are known: (1) equilibrium; (2) condensation; and (3) evaporation method, the second being most effective. Here the expelling gas partly condenses when in contact with crude. Critical and non-critical variations are known. In the former, composition of the liq and gaseous phases approach simultaneously the "critical" point when capillary forces = 0, and incomplete production (less than 100%) is only due to wrong placing of wells. In the latter, an equilibrium between gases and crude is established within each phase separately, and a great volumetric increase of the liq phase results, a feature absent in the other method, which otherwise appears to be best. This brief paper has previously appeared in Russian *Neftyanaya Promys'lennost*, 1957, **12** (47). M. S.

2187. Seeligson unit formed for secondary recovery. J. N. Schuelke. *World Oil*, 1958, **146** (5), 191.—The unitization of the Seeligson field in Jim Wells County, Texas, should increase ultimate recovery by 60 million brl, reaching *ca* 40% max ultimate increase. The field was found in 1937, and within the proposed unit area there are *ca* 14,000 productive acres with production from some 27 Frio oil and gas pays between 4400 and 6300 ft. Accumulations are controlled by combinations of anticlinal structure, faulted on the W., and sand distribution. In consequence, reservoir and development problems are extremely complex, and the engineering evaluation of the field for the unitization project was the most complex yet carried out for secondary recovery pressure maintenance. A special system of data processing was necessary to analyse the geological and reservoir data. Details of this are given, together with reservoir data on the field. The structure of the field is shown in maps and cross-sections. C. A. F.

2188. Hassi Messaoud and Hassi R'Mel. A. Perrodon. *Bull. Ass. franç. Tech. Pétrole*, May 1958, 227–36.—A section through Md. 2, 1, 4, and 8 (Hassi Messaoud) shows a very flat dome in Cambro-Ordovician, and the Trias lies in turn on the Tigillites quartzites and on the Hassi Messaoud sandstones. Seismic reflection and refraction data indicate the discordance, while refraction, probably at the basement, gives a fair picture of the productive sandstones (3000 m deep), which show 3 zones. Most wells stop in the middle zone at the base of the productive sequence. Porosities range 5–15% and permeabilities 1 mD to several hundred mD. Mio-Pliocene beds rest on Upper Cretaceous.

Hassi R'Mel produces gas from Triassic sandstones on a very flat dome. The Triassic sits on Devonian to Cambro-Ordovician beds at depths of *ca* 2000 m. Its permeability

seems to fall to the N. NW. of Hassi R'Mel is the smaller Tilhremt high, possibly separated by a fault zone.

Both structures are scores of km across. G. D. H.

OILFIELD DEVELOPMENT

2189. Petroleum developments in Mexico in 1957. E. J. Guzman and F. Mina U. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (7), 1523–36.—The number of wells completed in Mexico during 1957 decreased from 402 to 380; however, the average depth per well increased from 5407 to 6463 ft for a total footage of 2,514,165 ft, an increase of 340,357 ft over the total footage drilled during the previous year. 108 wells were exploratory holes (77 new field wildcats). New reserves were added through the discovery of 14 new oil and/or gas fields, 13 new pools, and 7 extensions to previously producing fields. The total number of successful wells was 273 (70·2%). Exploratory tests were 31·5% successful (34 wells).

E. N. T.

2190. Petroleum developments in South America and Caribbean area in 1957. E. W. Clarke. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (7), 1537–88.—The oil production of S. America and Trinidad again increased during 1957, and amounted to nearly 170,000,000 brl (3,204,357 b.d.), of which nearly 87% came from Venezuela. However, Venezuela's production, which was built up rapidly to a peak of 2,975,000 b.d. in June, was cut back to 2,500,000 b.d. by the end of the year. Trinidad production increased by 18% over 1956 and, with an average of 93,324 b.d., became the third largest producer in S. America and the Caribbean. Argentina increased production by nearly 10% to 93,018 b.d. Brazilian production increased from 11,100 b.d. in 1956 to nearly 28,000 b.d., and exploration and development continue actively.

Elsewhere in the Caribbean Islands and Central America, oil production remained small (1082 b.d. from Cuba), but there was considerable exploratory activity.

A total of 3074 wells, 1739 of them in Venezuela, was drilled in 1957, compared with 2606 wells in 1956. Both exploration and development drilling contributed to the high level of activity, which had fallen off appreciably by the end of the year. Nearly 350 exploratory wells, 39% of which found new oil accumulation, were drilled during the year.

New oil concessions were granted during 1957 in Venezuela, Bolivia, Colombia, Guatemala, Nicaragua, and Honduras.

E. N. T.

2191. Petroleum developments in Middle East and adjacent countries in 1957. H. Hotchkiss. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (7), 1680–708.—Petroleum production in the Middle East countries in 1957 totalled 1,293,399,074 brl, an average of 3,670,432 b.d. This is comparable with a total production of 1,257,611,320 brl in 1956.

Production in Pakistan in 1957 was 2,205,000 brl, an average of 6041 b.d. This is comparable with a total production of 2,114,390 brl in 1956. No production figures are available for India.

The general level of exploratory activity in the entire area remained high. Indicated oil discoveries were made in Saudi Arabia, and reports were received of a previously unreported 1956 discovery in Afghanistan. Exploratory drilling was initiated in Jordan. The Heletz field in Israel was extended to the S.

A petroleum law permitting participation of foreign capital in exploration work in certain parts of Iran was passed during the year, and licences were issued to a joint Iranian–Italian company. Rights covering Saudi Arabia's undivided half-interest in the Kuwait–Saudi Arabia Neutral Zone offshore area were granted to a Japanese company.

In W. Pakistan, Karsal 1 was brought on production.

E. N. T.

2192. Petroleum development in Africa in 1957. H. D. Hedberg. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (7), 1631–79.—Petroleum production in Africa reached a new all-time high of 18,502,728 brl in 1957. This represented an increase of more than 5 million brl over 1956, contributed largely by the newly developed Belayim field in Egypt, as well as by increased production from other Egyptian fields and the coming into commercial production of the Gabon fields of French Equatorial Africa. Angola showed a slight increase in production, and Nigeria for the first time entered the roll of producing countries. Both Algeria and Morocco showed declines as compared with 1956.

87 exploratory wells were completed in 1957, of which 24% were successful. 3 oil discoveries were made in French Equatorial Africa, one in Angola, one in Egypt, one in Libya, and one in Morocco. 10 gas discoveries were made in Algeria, 2 in French Equatorial Africa, one in Cameroun, and one in Morocco. Exploratory wells were completed, but without any successes, in French W. Africa, Ghana, Madagascar, Mozambique, Nigeria, Somalia, British Somaliland, Tunisia, and Zanzibar. 119 development wells were completed with 76% success. A total of 1,410,661 ft of hole was drilled in Africa in 1957, and at the end of the year 74 rigs were in operation.

E. N. T.

2193. Petroleum developments in Far East in 1957. G. F. Kaufmann. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (7), 1709–957.—Unsettled political conditions in Indonesia and continued disappointing results of drilling operations in Australia, Papua, the Philippines, and other areas of the Far East make up a rather dismal picture for the exploration efforts in this vast area during 1957. In spite of the poor exploration results, the overall crude oil production increased by nearly 24,500,000 brl during 1957; from an average daily production of 424,200 brl in 1956 to 492,350 brl in 1957. Of the total increase of 68,150 b.d., stepped-up production by Caltex Pacific Oil Co., in Central Sumatra, accounts for 58,514 b.d. increase. Other areas of the Far East, except Burma and Communist China, showed slight decreases in production during 1957.

E. N. T.

2194. Petroleum developments in Europe in 1957. R. E. King. *Bull. Amer. Ass. Petrol. Geol.*, 1958, **42** (7), 1589–630.—Petroleum production in Europe outside the Soviet zone increased by 16% over the preceding year, to a rate of 230,948 b.d. This was a new record, but was only slightly more than 10% of production in the Russian orbit. All countries but Austria showed increases, and Italian production more than doubled, due chiefly to further development of the Ragusa field. Geological and geophysical exploration continued at a high level, and exploratory drilling reached a new high. However, no major discoveries were made. In NW. Germany 3 discoveries in the N. part of the Lower Saxony basin, SE. of the Vecht field, were apparently the new finds of greatest significance. A new oilfield found S. of Wilhelmshaven on the North Sea coast was the second in a Middle Jurassic trough first found by drilling in 1955. A new depth record for Germany was made by a Permian gas exploration well, which reached 14,820 ft. In Italy, a new field, Noto, was found in Sicily, and there were 6 gas discoveries in the Po Valley, and in Sicily. By the end of 1957 only one of the gas fields appeared to be an important discovery. A depth record for Europe was attained by Piadena well No. 23, in the Po Valley, which reached 17,227 ft, probably still in the Middle Miocene. In the Netherlands, 5 oilfields and one gas field were discovered in the SW. part of the country. Another small oilfield was found in Nottinghamshire, England. There was considerable exploratory drilling in Greece, Spain, Portugal, and European Turkey, which revealed important new geological information but was unsuccessful. E. N. T.

TRANSPORT AND STORAGE

2195. Reduction of evaporation losses by floating plastic blankets. A. Champagnat. *Chim. et. Industr. (Genie Chim.* suppl.), 1958, **80**, 7–13 (cf. Abs. **1491**, 1957).—Parallel tests (blanketed and not) on 5 pairs of tanks showed evap diminution of 73–97% and also (JP 4) lowering of vap concn in tank to below explosive limit. PVC blanket is lasting (oldest, installed Apr. 1955, shows no signs of wear); largest size to date is 21 m dia, but 54 m dia (wt 2 tons) planned. Limit temp is 70° C, pure aromatics and certain org solvents are unsuitable. Layout of blanket in tank is described (diagram). V. B.

2196. Ethylene storage and distribution. H. C. Schutt and A. R. Mattioli. *Oil Gas J.*, 4.8.58, **56** (31), 74.—The first of a 3-part series deals w[illegible] some basic factors in ethylene storage, and limited facilities for integrated petrochemical plant. Materials for storage tanks in low temp service, and storage facilities in use and their installation costs are tabulated.

G. A. C.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

2197. Sohio's new Toledo refinery. Anon. *Oil Gas J.*, 23.6.58, **25** (56), 95.—An 8-part article describes Standard Oil Co. of Ohio integrated refinery and deals with plant layout, dual gas-recovery system, continuous in-line gasoline blending, central control centre, and reactor furnace layout of reformer. G. A. C.

2198. Technical and economic problems of a new oil refinery. K. Baranski. *Nafta (Krakow)*, 1958, **14**, 18–21, 46–9.—In the forthcoming development of energy requirements in all countries, atomic power will contribute a significant amount by 1968 at the earliest. By then petroleum will have reached the figure of 31% of all sources of energy. W. European economy can draw on the Middle East resources and E. Europe, and China can rely on the U.S.S.R. The total by 1975 will be 2000 million tons p.a. In future plans for her own expansion Poland has to consider the availability of crude and refined materials. Since petrol appears to be more available than heavier oils, Poland's planned refinery will have to provide more of the latter. Here medium-pressure hydrocracking process of Prof. Varga should prove useful. The crude likely to be available will contain a large proportion of sulphur whether it comes from the Middle East or the U.S.S.R. Only large refineries can deal with this economically. The crudes all contain a large proportion of paraffins. Resulting low octane spirit should be reformed. Cat costs $9/kg, and its regeneration costs $4/kg. Investment fell to $7/ton p.a. input. 14% of the crude input will eventually reach the reformer. Cracking is not economically desirable. A small refinery could treat some gasoline by platforming even before a new refinery is built. Otherwise they would have to deal with straight-run gasoline of no less than 55 O.N. to produce a reasonably priced product. "Own costs" in large refinery will be lower by *ca* 30%. Decision to build a new refinery in Konin, due to its central position and amenities, was taken in 1953. Work should begin in 1959.

M. S.

2199. Foundation design handbook for stacks and towers. V. O. Marshall. *Petrol. Refin.*, 1958, **37** (5), suppl.—The author gives a complete and concise account of the theory involved in the design of stacks and towers. Included in the work are the actual design of foundation types commonly required in the erection of refinery vessels. J. R. T.

2200. Use salt water cooling towers. W. W. Mitchell. *Chem. Engng*, 1958, **65** (12), 181–2.—Lack of fresh water for cooling refinery units, and the cost of pumping sea water over distances and of separating oil from waste water has led one American refinery to install salt water cooling towers as an economy measure. Induced draught counterflow redwood cooling tower cells are used, with modifications to reduce windage losses. Pumps, etc., are made of stainless steel and Monel alloy to combat corrosion, and all cooling water lines are cement-lined steel pipe. One cooling tower has now completed 18 months satisfactory service. P. J. O.

2201. French stainless steels equivalent to corresponding ASTM steels. P. Villain. *Rev. Inst. franç. Pétrole*, 1958, **13**, 246–58.—ASTM (1955) Ni–Cr austenitic steels are considered in 3 classes: 18/8, 18/8 stabilized, and 18/10 Mo. In each class the ASTM spec are analysed and compositions tabulated. It is not possible simply to list French equiv. W. A. M.

2202. Aluminium in the oil industry. II. S. Black. *Petrol. Times*, 20.6.58, **62** (1588), 505.—This part continues with applications in drilling rigs, pipelines, storage tank heating coils, heat exchangers, thermal insulation cladding, storage and reaction vessels in petroleum chemicals industry, road, rail, and sea tankers and smaller containers, paint, and structures. G. A. C.

DISTILLATION

2203. New relative volatility method for distillation calculations. F. W. Winn. *Petrol. Refin.*, 1958, **37** (5), 216–18.—The author presents a new method of relating the vapour–liq equilibrium K ratio of one component to that of another, and shows how a simple test of applicability may be carried out. The relation holds accurately for many systems at constant pressure, even though the temp may vary several hundred degrees. Potential applications of the relation include the calculation of minimum reflux and the number of equilibrium stages at finite reflux ratios. J. R. T.

2204. Better estimate of entrainment from bubble-cap trays. J. R. Faire and R. L. Matthews. *Petrol. Refin.*, 1958, **37** (4), 153–8.—Entrainment causes a lowering of transfer efficiency through recycle of liq between the trays. The authors present an empirical method for estimating entrainment in bubble cap columns on a theory of "corresponding states." The conditions involved are relative to flooding. Design charts and a sample calculation are presented for estimating both entrainment and flooding. The correlation is shown to represent experimental data from a variety of sources within ±20%, in the region where entrainment affects dist efficiency significantly. The reliability of the entrainment correlation has been checked against all applicable published data. J. R. T.

2205. Design packed columns graphically. J. J. Ozermann *et al. Petrol. Refin.*, 1958, **37** (4), 165–72.—The tedious and complicated calculations for designing packed columns may be made easier with the aid of diagrams. The authors present diagrams for obtaining the height, dia, and pressure drop of Raschig ring-packed columns. Similar diagrams can be pre-

pared for other types of packing. The various calculations used for constructing these diagrams are discussed systematically, and a sample calculation is given. The exactitude of the diagrams is shown by comparison with numerical methods. J. R. T.

CRACKING

2206. Process feed for more cat gasoline. W. V. Medlin *et al. Petrol. Refin.*, 1958, **37** (5), 167–72.—Cat cracking is an important refinery tool for the production of ever increasing quantities of high quality gasoline. The trend in feed preparation is to produce larger quantities of dist suitable for cat cracking feed. The authors discuss the processes which produce high yields of cat cracking feedstock under vacuum flashing and " deep feed preparation," the latter dealing with flash cracking, solvent extraction, and coking. J. R. T.

2207. Hydrogen improves cat cracker feed. M. D. Abbott *et al. Petrol. Refin.*, 1958, **37** (5), 161–6.—Hydrotreating of cat cracking feedstocks not only reduces the sulphur and nitrogen contents of the oil, but, under suitable conditions, converts a large proportion of the condensed polyaromatic cpds to monoaromatics. The authors present details of experimental hydrogenation of cat cracking feeds, showing that there need be no loss in cracked gasoline aromatics even though the coke-forming polyaromatics have been efficiently broken down. Thus hydrogenation benefits both the yield structure and product distribution resulting from cat cracking, and in addition removes the metallic contaminants of the oil, which tend to deactivate the cracking cat. J. R. T.

2208. Nickel and cobalt catalysts in the petroleum industry. P. D. Wilmot. *Petroleum, Lond.*, 1958, **21** (6), 187–90.—Principles of catalysis and the surface mechanisms of several cat reactions used in the petroleum industry are outlined, with emphasis on cat metals of the iron group. A. E. R.

2209. Radioactive coke-level indicators increase delayed-coker capacity. P. G. Wright. *Oil Gas J.*, 11.8.58, **56** (32), 93.—Use of the indicators at the coking units of Socony Mobil Oil Co.'s East St Louis refinery permitted increase of both temp and steam rate, resulting in reduced foam height, and prevented carry-over. G. A. C.

POLYMERIZATION

2210. Gasoline from a liquid poly catalyst. E. D. Kane and G. E. Langlois. *Petrol. Refin.*, 1958, **37** (5), 173–6.—The potential advantages of a liq cat have long been recognized, but the lack of suitable equipment to withstand liq phosphoric acid corrosion at the required acid strength and temp prevented any advance in this field. The authors give details of a new process for polymerizing a propylene or mixed propylene–butene feed using liq phosphoric acid as a cat. A suitable alloy was found and enabled fabrication techniques to be worked out. The hydrocarbon feed and the acid cat are contacted in a high efficiency, orifice plate reactor. The main advantages of the process are stated to be excellent temp control, high olefin conversion, simplified product recovery, and high operating factor. J. R. T.

ALKYLATION

2211. Sulphuric acid alkylation. P. W. Sherwood. *Petroleum, Lond.*, 1958, **21** (6), 191–5.—Alkylation is regaining in importance due to its lower cost in relation to other upgrading processes as the O.N. of gasoline increases. Processes of alkylation, the effect of operating variables, types of reactor, and methods of disposal of alkylation acid are described. A. E. R.

CHEMICAL AND PHYSICAL REFINING

2212. An examination of the distillation characteristics of hydro-refined benzole. D. Spencer. *Industr. Chem. Mfr*, 1958, **34**, 287–93.—Crude benzole from coal tar can be fractionally dist to give benzene containing unsaturated and S-containing hydrocarbons as main impurities. At present these are removed by conc H_2SO_4 treatment, but hydrogenation of these cpds over Co–Mo oxide cat at 350°–400° C and 20–35 atm using H_2 or coke oven gas is practised commercially on the Continent, and is at present in the pilot plant stage in the U.K. Fractionation of hydro-refined product calls for 3 columns, from which C_2–C_5, C_6, and C_7 paraffins are taken successively overhead, with benzene and toluene as stripped side streams and xylenes as residue. If the paraffin content is high ($> ca$ 15%) an extraction process such as Udex or extractive or azeotropic dist may be desirable. Efficiency of fractionating equipment followed by gas–liq chromatographic analyses. Vap–liq equilibria for components of hydro-refined benzoles are given. A. C.

METERING AND CONTROL

2213. French manufacture of measuring and control instruments for the petroleum industry. G. B. de Livois. *Rev. Inst. franç. Pétrole*, 1958, **13**, 861–5.—Measuring instruments are surveyed briefly under following headings: pressure, differential pressure, level, flow, temp, O_2 analysers, pH meters, transmission over a distance, miniature recorders, electronics. Particular attention is paid to modern trends. Modes of functioning of different control systems are described and their advantages and disadvantages outlined. French instrument manufacturers can now supply nearly all the equipment required by French refineries. W. A. M.

2214. Meter calibration. M. A. Levy. *Oil Gas J.*, 30.6.58, **56** (26), 107.—Calibration methods and effect of visc on meter factors are discussed, citing practices of 4 large oil refiners. G. A. C.

PRODUCTS

CHEMISTRY AND PHYSICS

2215. Combustion of gaseous mixtures. *Rev. Inst. franç. Pétrole*, 1958, **13**, 311–734.—Report (42 papers and discussions thereon) of meeting of phys–chem section of XVI Int. Cong. Pure Applied Chem. Authors' summaries of papers more directly concerned with hydrocarbons, etc., follow: **Combustion study by cinespectroscopy.** R. G. W. Norrish. 313–32.—This is a valuable means of following fast reactions, especially flame and pre-combustion. Course of reactions of H_2, hydrocarbons, H_2S, etc., with O_2, initiated by flash photolysis, can be plotted at intervals as short as 20 microsec. **Effect of formaldehyde on the combustion of rapidly flowing methane/air mixtures.** A. Egerton and K. K. Ray. 366–7.—Flowing gases are separately preheated and then mixed, reaction is followed by probe. HCHO is present in products in greater concn than CO and below temp at which diminution of CH_4 concn is detectable by i.r. analysers. HCHO addition, even though only a small proportion survives the pre-heat, increases oxidn rate of CH_4. **Influence of formaldehyde and acetaldehyde on low temperature combustion of pentane.** J. Chamboux and M. Lucquin. 368–71.—Small amounts of HCHO and CH_3CHO were added to C_5H_{12}/O_2 mixtures to determine effect on chem mechanism of saturated hydrocarbon

combustion and on explosion limits. **Influence of flow pattern in an annular reactor on oxidation of pentane and on the negative temperature coefficient of the reaction.** R. O. King, S. Sandler, and R. Strom. 372–7.—Tests, atm pressure, with C_5H_{12}/air mixtures fed to reactor formed by annulus between concentric tubes of high-silica glass. Existence of low temp reaction of appreciable velocity in a chemically correct mixture depends on supply rate $\geqslant$200 ml/min; at this rate small scale reaction begins at 420° C, attains max velocity at 470° C, temp coeff then becomes neg and reaction ceases at 505° C. No further appreciable reaction occurs until high temp reaction commences at 650° C. As supply rate is reduced rate of low temp reaction increases and reaction-free temp range narrows until, at 50 ml/min, there is no separation between low and high temp reaction zones. Low temp reaction is characterized by initial aldehyde formation, without indication, either by luminescence or pressure fluctuations, of existence of cold flame. Results support view that neg temp coeff is surface effect. **Study of hydrocarbon oxidation under strictly controlled experimental conditions.** Z. G. Szabo and D. Gal. 414–27.—Investigations of hydrocarbon oxidn have sometimes led to contradictory results because of: (1) insufficiently rigid exptl conditions; (2) large number of parallel and consecutive reactions possible; (3) oxidn processes are frequently stopped before all of initial reactants are consumed. By application of certain cat effects attempts have been made selectively to increase proportion of some intermediate products; the action of the cat enables deductions to be drawn concerning mechanism of primary reaction and on the nature of the catalysed stages. Tests were in all-glass apparatus, oxidn of C_2H_6, C_2H_4, and C_2H_2 studied and cat effect of H_2O, I, NO, and NH_2CH_3. **Second stage ignition in the combustion of saturated hydrocarbons.** M. Lucquin. 428–37.—Experimental results on second stage ignition and especially its explosion limit. Cool flame is considered as a perturbation of the initial mixture, allowing the normal flame to occur at a lower temp. **Thermal aspect of the low temperature combustion of *n*-pentane/oxygen mixtures.** R. Ben Aim and M. Lucquin. 438–42.—Temp variations inside reactor are determined; study of slow reaction shows following steps: sudden cessation; existence at low temp and high pressure of 2 maxima, forecastable by pressure readings; existence at high temp of single max, leading without transition to a cool flame. **Slow combusion of mercaptans.** C. F. Cullis and L. C. Roselaar. 466–73.—Et and Me mercaptans start to react with O_2 at 200°–250° C. Many characteristic features of hydrocarbon combustion, such as auto-catalysis, are only weakly developed and both mercaptans appear to inhibit their own oxidn, which is strongly accelerated by O_2. SO_2 is always the predominant S-contg product, although disulphide formation apparently occurs to a significant extent in O_2-lean mixtures. Main oxidn appears to involve initial abstraction of H from the SH group, with production of RS radical, which then reacts with further O_2 giving SO_2 and an alkyl radical, subsequent reaction consists essentially in further oxidn of latter. **Reaction of the *n*-butane flame with nitrogen peroxide.** W. W. Wharton and E. Miller. 474–82.—3 phases of work on *n*-C_4H_{10}/NO_2 flame: (1) kinetic analysis, considering flame as flow reaction, deriving equations giving rate, spec rate, and activation energy; data from flame emission spectra being used; (2) description of first combustion stage based on mass spectrography of gas samples; (3) general kinetic interpretation and evidence that first stage of combustion process is reaction of *n*-C_4H_{10} with atomic O from decomp of NO_2. **Kinetics of combustion of propane in nitrous oxide.** M. Destriau and P. Laffitte. 500–5.—Kinetics are studied in homogeneous gas phase and in presence of NiO. First stage of reaction is deduced and explanation of experimental facts given. **Point of attack of oxygen in the combustion process.** E. A. Braude *et al.* 514–20.—Although there is substantial indirect evidence that, in combustion of saturated hydrocarbons oxidn occurs at CH_2 (or CH) rather than at CH_3, little direct evidence has as yet been provided to support this view. Below *ca* 400° C an important final product of hydrocarbon combustion is CO. If therefore a fairly large hydrocarbon molecule is oxidized with a deficit of oxygen the C derived from the initial point of oxygen attack will probably predominate in any CO formed. It should therefore be possible to obtain direct experimental evidence as to the point of attack by tracer experiments with hydrocarbons containing ^{14}C at various points. Methods were devised for synthesis of methyl-2-pentane labelled in each of the skeletal positions in turn. Combustion of these labelled cpds with an insufficiency of oxygen was carried out at 242° C and at 380° C, and the CO formed was further oxidized by preferential combustion on CuO. The spec activity of the resulting CO_2 was then determined in the liq phase by absorption in lithium phenyl soln. The results obtained at the lower temp indicate preferential formation of CO from the C_3 position. **Hydrogen peroxide in the products of combustion of mixtures of *n*-butane and air at low pressures.** M. Prot, R. Delbourgo, and P. Laffitte. 527–32.—Variables were % of C_4H_{10} and furnace temp. H_2O_2 formed reaches max at 6% C_4H_{10}, corresponding to an unstable flame. **Influence of preheating on flame velocity in light gasoline/air mixtures.** L. N. Khitrin and E. S. Golovina. 533–7.—Propagation velocity of flame is measured under laminar and turbulent conditions using Bunsen burner with central or peripheric ignition and with incoming mixture at 17°–230° C. Flame propagation velocity increases with temp, and to same extent, under both conditions. **Influence of reduced pressure on normal flame velocity.** S. A. Goldenberg and V. S. Pelevine. 538–43.—Tests at 100–760 mm on aviation gasoline/air and (75% CH_4, 25% CO_2)/air over wide concn range in 16-mm cylindrical burner. Normal velocity increases with falling pressure, propagation limits tend to contract. **Study of the mechanism of the propane/air reaction by analysis of flame fron. profiles.** R. M. Fristrom, A. A. Westenberg, and W. H. Avery. 544–53.—Determination of flame front structure provides a new and powerful technique for the study of high speed, high temp reactions. It offers a considerable insight into the mechanism of reactions occurring in flames and, in cases of propane/air flame, it appears to be possible to establish the existence of a single dominant reaction for the initial attack of C_3H_8. This reaction $C_3H_8 + H^{\cdot} \rightarrow H_2 + C_3H_7^{\cdot}$ is the same as the initial reaction proposed in the Rice–Herzfeld cracking mechanism. Quant treatment of these data to evaluate kinetic constants is possible in principle wherever the appropriate concn profiles are available. This was not possible in the case of the simplified example chosen because concn profiles of the atomic and free radical species are not yet available. **Hydrogen engine.** R. O. King *et al.* 577–85.—Brief account of combustion difficulties when using H_2 instead of liq fuel in Otto cycle engines. Experiments show that difficulties arise from: (1) loss of cooling effect due to vaporization of liq fuels; (2) premature ignition and detonation from lub oil. These difficulties can be overcome and H_2/air mixtures used in CFR engine at C.R. of 20/1, with slightly knocking combustion due to very high rate of flame propagation.

2216. Infra-red absorption spectra of complex phenols. J. Favre and G. Parc. *Rev. Inst. franç. Pétrole*, 1958, **13**, 267–88.—I.r. spectra (2–15 μ) of 6 mono-, 7 di-, and 10 tri-substituted phenols (mainly alkyl substituents) are presented. Methods of preparation and physical properties of 6 of these cpds not previously given (cf. Abs. **2020**, 1957) are listed. Mono- and di-substituted phenols give spectra which are shown to accord with known correlation rules. Tri-substituted phenols show strong absorption in range 11·5–11·9 μ. Complete analysis of spectrum of 2-*tert*-Bu-4-Me-6-*cyclo*hexylphenol is

given. Relative val of steric hindrance of *o*-substituents are obtained from $\Delta\lambda$ (displacement due to association of OH).
W. A. M.

2217. Liquid–liquid equilibria of ternary systems consisting of two hydrocarbons and a solvent. Y. L. Gladel and J. Durandet. *Rev. Inst. franç. Pétrole*, 1958, **13**, 780–1.—Further list (cf. Abs. **1344**, 1957) of 22 new equilibria published in 1957. 4 new solvents (ethylene and propylene carbonates, *bis*-(β-cyanoethoxy)-ethane — 1 : 2, dipropylene glycol) appear.
W. A. M.

2218. Predict diffusion coefficient, D. W. R. Gambill. *Chem. Engng*, 1958, **65** (11), 125–8.—A survey of reliable prediction and extrapolation methods for the extension of published data on gas diffusivities is made. Values of D are frequently needed in dist calculations, but not always available in the literature. An indication of the accuracy of each method is given by comparison with experimental results, and multicomponent mixtures are briefly considered. P. J. O.

2219. Reactions of hydrocarbons in an electric field. H. Luther and K. Mertlich. *Naturwissenschaften*, 1958, **45**, 57–8.—Tests on oils of mol. wt. *ca* 300 (paraffin oil, transformer oil, alkyl-benzenes) at 500 Hz, 5–12 kV, gap 21·5 mm, 50°–80° C, 6–8 hr in apparatus designed by authors showed condensation of some of starting material into largely insol waxy products with little change in i.r. spectra and some shift to red in u.v. Action of electric field was to accelerate O_2 absorption. H_2 is absorbed more by condensation products than by starting material; apart from H_2, lower hydrocarbons (to C_5), both satd and unsatd, are also evolved. Reactions concerned are largely surface effects, and hence not only chem composition but phys properties (*e.g.* v.p., surface tension) of starting materials are significant. V. B.

2220. Novel circuit for delivering known spark energies. T. A. Erikson. *Rev. Sci. Instrum.*, 1958, **29**, 173.—A method of obtaining electric sparks of known energy level for ignition of combustible mixtures is described. In principle 2 capacitors of approx equal value are connected in series across the spark gap. Both are charged to a pre-selected value, then one is discharged. The potential across the spark gap increases, whereupon the other capacitor delivers its stored energy across the gap with minimized energy loss. H. C. E.

2221. Distance between emulsified oil globules upon coalescence. M. van der Tempel. *J. Colloid Sci.*, 1958, **13**, 125–33.—Drops of a paraffinic hydrocarbon (medicinal white oil, $d = 0{\cdot}875$ g/ml) of controlled dia 1–3 mm were produced by pressing the oil through circular holes in 2 spherical vessels immersed in aq soln containing NaCl with Na dodecyl sulphate or a polyethylene oxide ether of a fatty alcohol. The distance between the 2 interfaces was found by an interferometric method using a microphotometer.

Drainage of the water film between the drops occurred much faster than would be predicted from Reynolds' equation (which, however, applies to drainage between 2 parallel surfaces) and was complete within one hr when the film thickness was *ca* 1000 Å. It is shown that a high potential barrier of electrostatic origin prevents closer contact. Spontaneous coalescence occurs, usually after several hr, immediately the film is ruptured. The thickness of the film decreases with increasing NaCl concn. A theory which takes into account only electrostatic repulsion and van der Waals–London attraction predicts a decrease in film thickness with increasing salt concn that is more rapid than is actually the case, and it is therefore suggested that other repulsive forces become operative at distances less than *ca* 125 Å. H. C. E.

2222. Methane-conversion detector for gas chromatography. A. Zlatkis and J. A. Ridgway. *Nature, Lond.*, 1958, **182**, 130.—Thermal conductivity cells, used in gas chromatography, have decreased sensitivity at the higher temp which are sometimes needed to prevent condensation of the components of high b.p. This drawback can be overcome by converting the components to water, which is removed in a drying column, and methane, which can be measured in the cell at ambient temp. The conversion is carried out, when H_2 is the carrier gas, with a hydrocracking cat at the exit end of the chromatographic column; the cat in this expt was 30–60 mesh Ni at 350°–450° C.

In addition to the increased sensitivity, calibration for differences in thermal conductivities of the separated components is unnecessary; and materials other than hydrocarbons can also be analysed. The method has been applied to C_1–C_{12} paraffins and olefins, to C_5–C_8 naphthenes, and to C_2–C_5 aldehydes, alcohols, and ketones. H. C. E.

2223. Gas chromatographic separation of *m*- and *p*-xylenes in aromatic mixtures. A. Zlatkis, L. O'Brien, and P. R. Scholly. *Nature, Lond.*, 1958, **181**, 1794.—Using as stationary phase benzyldiphenyl at 100° C in a column 5 m in length (9500 theoretical plates), all aromatics of general formula C_nH_{2n-6} ($n = 6$ to 8) were mutually separated from a mixture (cf. Abs. **931**, 1958). H. C. E.

ANALYSIS AND TESTING

2224. Instrumental analysis of petroleum. Anon. *Lubrication*, 1958, **13**, 217–28.—4 major divisions of instrumentation—absorption, emission, and X-ray spectroscopic techniques, all concerned with bands of radiation found in the electromagnetic spectrum, and mass spectroscopy—are described and discussed with supporting diagrams. Application of these processes to petroleum analysis saves enough to pay for the instruments in 2 years. The vast field covered by instrumental analysis includes research and production problems, often impractical to solve by conventional analytical methods.
R. T.

2225. Analysis of hydrocarbon mixtures. (In German.) G. Kühnhanss *et al.* *Erdol u. Köhle*, 1957, **10**, 435–41.—Pt 2. Development of a rapid analytical method. The procedure described—using 2 val only, $n - \frac{d}{2}$ and d—is applied to the analytical detection of multicomponent mixtures and synthesis products. Equations are derived for determining aromatic and naphthene cont. Calculations for side cuts from the TTH stripper, *e.g.* machine, spindle, and diesel oil 2, are simplified by using the nomograms presented. This method is applicable to the most varied high-b.p. products of the mineral oil industry. Numerous charts are presented.
R. T.

2226. Chemical structure of mineral oils and influence of temperature on viscosity. J. Cornelissen and H. I. Waterman. *Chim. et. Industr.*, 1958, **80**, 3–10.—For petroleum dist with visc 20° C < 10 cS log ν_{10} and log ν_{70} vary linearly as a function of log ν_{20} and the 2 straight lines, for hydrogenated and non-hydrogenated fractions respectively, lie very close to one another. In the 3-dimensional model for log ν_{20}–*n*–*d*, which enables the % C_A and % C_N content of the cuts to be determined, the surfaces for equal values of log ν_{10} and log ν_{70} are planes parallel to the plane of the (n_D^{20}–d_4^{20}) co-ordinate.
(Authors' summary.)

2227. Altering refractive index and density of hydrocarbons by hydrogenation and isomerization. (In German.) J. A. Meys, H. I. Waterman, and D. W. van Krevelen. *Erdöl u. Kohle*, 1957, **10**, 428–9.—In saturation of olefins and aromatics and

isomerization of hydrocarbons d and n are altered. For saturation $\frac{\Delta n}{\Delta d} = ca\ 0{\cdot}85–1{\cdot}00$, for isomerization ca 0·45. By means of the n–d curve in hydrogenation of aromatic substances, saturation and isomerization of pitch, anthracene oil, etc., can be followed up experimentally. 10 refs. R. T.

2228. A rapid method for the determination of the aromatic contents of petroleum fractions boiling above the kerosine range. B. M. Brook and B. T. Whittam. *J. Inst. Petrol.*, 1958, **44** (415), 212–14.—This describes a rapid small-scale elution chromatographic procedure. It separates and determines saturates and aromatics in olefin-free fuels and oils by adsorption on silica gel. The cut point between the 2 fractions is determined by a filter paper spotting technique. Its advantages over the FIA method are pointed out, and deviation of results from a standard procedure over a range of oils is given. 3 refs. E. M. I.

2229. Rapid spot test methods for the evaluation of used transformer oil. R. E. Reinhard, W. E. Elliott, and E. P. Schram. *Amer. Inst. Elect. Engr*, 1958, Preprint 58–786, 7 pp.—Paper chromatographic methods, suitable for field use, for determining acid val and IFT are described. Acid val test (useful range 0·01–0·50 mg KOH/g) is based on colour changes with Na_2CO_3 soln, using BDH universal indicator. Test interpretation is facilitated by comparison with pattern given by oil of known acidity. Correlation for 108 samples between chromatographic method and ASTM D664 shown, and is considered adequate (*ca* within 0·1 mg KOH/g) for oil maintenance checks. IFT can be estimated on a "go–no go" basis, using value of 18 dynes/cm as dividing line, by shape of spot obtained using Polar Contaminant Indicator soln (not further defined). Indicator absorption time (in range to *ca* 250 sec) is numerically similar to dur n (days) of accelerated aging (method not stated). V. B.

2230. New methods for gas analysis with gas chromatography. (In German.) J. Janak. *Erdöl u. Kohle*, 1957, **10**, 442–4.—Chromatographic separation is explained with a supporting diagram. Types discussed are frontal, displacement, and elution chromatography. The terminology used hitherto is criticized and modifications suggested. Separation of permanent gases at room temp is possible only with very active types of activated C. 3 groups, distinguished by their adsorption energy, can be separated: (1) H, He, and Ne; (2) O_2, N, and Al including CO and NO; (3) CH_4. Synthetic and natural zeolites are used in permanent gas separation. Polarity of the active surface and homogeneous pore dimensions—of mol order—permit a more exact distinction between CO and N, O_2 and N, etc. CO_2– snow temp is employed with H_2 supporter gas. Alusil, a sodium aluminosilicate of Czechoslovakian origin, is used as adsorbent. Separation of the He and Ne group results on activated C Supersorbon at liq–air temp. Relation between the polarity of the solid phase and sorption selectivity of the unsaturated material with asymmetrical mol is discussed. Differences in selectivity of dimethylformamide films on kieselguhr and on surface-active sodium aluminosilicate are so great that propylene, which falls with *iso*butane on kieselguhr, can be separated completely on silicate. A discussion follows. 9 refs. R. T.

2231. Gas chromatography. H. H. Hausdorff and N. Brenner. *Oil Gas J.*, 30.6.58, **56** (26), 73; 14.7.58, **56** (28), 122; 21.7.58, **56** (29), 86; 4.8.58, **56** (31), 89.—The first part of a 4-part contribution describes the methods whereby a mixture of components is carried through a column by a carrier gas and the separated components are measured at the exit by a suitable detector.

Pt 2. A commercial vapour fractometer is described based on elution–partition chromatography. A schematic diagram and detector circuits are depicted.

Pt 3 deals with the 6 variables for effective gas chromatography, an 8-component mixture being used to study effect of flow rate, pressure, temp, instrument sensitivity, column dimensions, and column material on running speed, obtainable separation, and accuracy of quantitative determination.

The concluding article gives limitations of the procedure, and the advantages of the technique are summed up.

G. A. C.

GAS

2232. Investigate the hot potassium carbonate process for acid gas removal. R. A. Graff. *Petrol. Engr*, 1958, **30** (5), C24–6.—The hot potassium carbonate process for the removal of relatively high concn of hydrogen sulphide or carbon dioxide from refinery gas streams is described. Operating temp of the hot soln is 220°–240° F. Absorbers and strippers are packed with Raschig rings, and mild carbon steel is used as the material of construction, except at points of high turbulence, which require stainless steel. Compared with the amine process, this process recovers double the amount of gas per unit of process steam with greatly reduced cooling requirements. Costly make-up chemicals are not needed.

A. E. R.

2233. Practical design considerations for gas purification processes. F. Zapffe. *Petrol. Engr*, 1958, **30** (5), C19–22.—Design details and problems connected with the amine and iron sponge box processes for removal of hydrogen sulphide and carbon dioxide from natural gas or refinery gas streams are given. For the amine process, 0·3 mol of acid gas per mol of amine is the max loading recommended to minimize corrosion. Low amine strengths of up to 12% are desirable, and amine losses due to entrainment are reduced by fine wire mesh packing. The bed depth in the iron sponge box process should be at least 10 ft, and the vessel dia should be enough to limit sulphur deposition to a max of 15 grains/sq. ft/min Contact time should be 15–20 sec. A. E. R.

ENGINE FUELS

2234. How do mixtures affect knock ratings? E. J. Y. Scott. *Petrol. Refin.*, 1958, **37** (5), 191–200.—The development of higher C.R. in modern transport ensures that the intrinsic power of the fuel is used as economically as possible; however, the accompanying knock restriction has now become a limiting factor in choosing fuel blends. The author presents a detailed study of how hydrocarbon types influence the knocking tendencies of blends and shows that, by predicting certain basic types of mechanisms, some of the characteristic recurring curves for hydrocarbons in match blends can be explained. J. R. T.

2235. Modern aviation fuels. R. Uson Lacal. *Combustibles (Zaragoza)*, 1958, **96**, 57–69.—Review of properties of fuels for the modern aircraft engine, with particular reference to jet fuels. Problems of combustion chamber deposits, stability, filter clogging, and tests to assess these are discussed. A. C.

LUBRICANTS

2236. On the boundary lubricity of non-polar hydrocarbon oils and their mixtures. Yasukatsu Tamai. *J. Inst. Petrol.*, 1958, **44** (415), 207–11.—Boundary lubricity was investigated by measuring the coeff of friction and electrical contact resistance between steel surfaces during reciprocating and repetitive sliding, and the effects of different temp and the

surrounding atm. Dry steel was used as a blank and results compared with benzene, di*cyclo*hexyl methane, decalin, and cetane. They had no friction- or wear-reducing properties but did show dust-excluding ones. Solid cetane, liq cetane under varying conditions, and 2 mixtures, cetane–*n*-heptane, and cetane–decalin, were investigated and showed wear-reducing properties when below the m.p. of cetane. This phenomenon was not explained. 10 refs. E. M. I.

2237. Lubrication problems arising from railway traction modernization. G. A. Dickins and W. B. Broadbent. *J. Inst. Petrol.*, 1958, **44** (415), 183–206.—Diesel and electric traction are the 2 new developments in this field. The first is divided into 3 categories—shunters, railcars, and locomotives—and details are given of the types of unit in each category, the probable lubrication requirements of the engines, and transmission employed. Types of lubricant are considered with regard to its duties, etc., and establishment of good lubrication maintenance stressed. Analysis procedures are suggested and a possible interpretation of the results given in an appendix. Electric traction is discussed and the suitability of different grease compositions to cope with the heavily laden bearings. More experience is needed in this field. Mention is made of experiments with dual-fuel engines, in which detergent oils will be utilized, and of the free piston engine, in which development indicates the use of a detergent oil and anti-oxidants. 6 refs. 10 pp. discussion. E. M. I.

2238. The mechanical evaluation of lubricating greases. J. H. Harris. *Petrol. Times*, 15.8.58, **62** (1592), 698.—The need for rig tests of greases for ball and roller bearings, history, present situation, and future developments are discussed. High speed, high and low temp, and water resistance tests are reviewed. G. A. C.

BITUMEN, ASPHALT, AND TAR

2239. Bitumens from Tujmas (U.S.S.R.) and Nagylengyel (Hungary) crude oils. (In Hungarian.) Gy. Nyul, P. Zakar, and Gy. Mózes. *Magyar Kémikusok Lapja*, 1958, **13** (4), 132–6.—In Hungary fuel oil has been produced since 1957 by atmospheric dist as a main product from the Tujmas crude oil. It became necessary to determine the quality of bitumen to be obtained by vacuum dist. Comparison of Hungarian Nagylengyel and Tujmas bitumens has shown that the former is of high asphaltene content, has a low temp susceptibility, and its quality is similar to the bitumens of gel character. The Tujmas bitumen is of low asphaltene content, having high temp susceptibility, and its quality is similar to bitumens of the pitch type.

Favourable qualities are produced by mixing the 2 bitumens. It would be profitable to use Tujmas bitumen for briquetting purposes. P. Z.

2240. Notes on compaction of asphaltic concrete. G. E. Zorger. *Rds & Str.*, July 1958, **101** (7), 128.—Close control of temp during knock-down rolling of the hot-mix is shown to be necessary for uniform pavement quality. 2 graphs illustrate the article. G. A. C.

DERIVED CHEMICAL PRODUCTS

2241. Main chlorinated compounds derived from propylene. E. Charles. *Bull. Ass. franç. Tech. Pétrole*, 1958, 381–93.—Brief general considerations on reaction of Cl with olefins followed by notes on manufacture of: dichloropropane, allyl chloride (leading to allyl alc, glycerol dichlorhydrin, epichlorhydrin, glycerol, *cyclo*propane), propylene monochlorhydrins (leading to propylene oxide, propylene glycol), carbon tetrachloride, perchlorethylene. V. B.

CORROSION

2242. Use lead to control refinery corrosion. E. J. Mullarkey. *Petrol. Refin.*, 1958, **37** (4), 201–6.—The author brings up to date the latest practices related to lead chemical construction. A general treatment for each of the methods for installing lead for corrosives service is given, together with the difficulties encountered and the ways to avoid them. He also shows that typical plant case histories add to the useful knowledge of lead's employment in combating corrosion. J. R. T.

2243. Internal cathodic protection of refinery equipment. R. A. Lowe. *Petrol. Times*, 4.7.58, **62** (1589), 602.—Modern technique of water cooling to prevent excessive corrosion in plant operation is outlined, employing cathodic protection to the bare metal surfaces. An example is given on a length of 24-inch i.d. steel unlined pipe carrying sea water, using a certain lead alloy as anode. G. A. C.

2244. Methods of fighting corrosion in light hydrocarbon liquid plants. J. S. Connors and C. L. Sayer. *Oil Gas J.*, 21.7.58, **56** (29), 93.—Typical problems, diagrams, and treatment of corrosion are discussed in aq-amine treaters, steam and steam-condensate systems, and cooling-tower piping corrosion. G. A. C.

2245. Six ways to fight corrosion in light hydrocarbon processing plants. J. S. Connors and C. L. Sayer. *Oil Gas J.*, 28.7.58, **56** (30), 176.—Corrosion in butane-isomerization units, mainly caused by the action of hydrogen chloride on temp in feed and cat can be tackled by inhibitors, process changes, use of special metals and design, zinc-dust coatings, and cathodic protection. Case diagnosis and remedies are quoted. G. A. C.

2246. Lab inhibitor stops DEA corrosion. J. D. Sudbury *et al. Petrol. Refin.*, 1958, **37** (5), 183–4.—Details of lab studies to discover a suitable corrosion inhibitor for the alkanolamines are given. The type of corrosion experienced with the alkanolamines is discussed. Results showed that a condensation product of polyethyleneamines and unsaturated alcohols was an effective inhibitor in the liq phase. No claim is made that the inhibitor will reduce the very serious corrosion often found in the vapour phase in reactivator columns. J. R. T.

2247. Corrosion control in tankers. A. Logan. *Trans. Inst. mar. Engrs*, 1958, **10** (5), 153–94.—This paper outlines the problems of corrosion in the cargo and ballast spaces of tankers used in black and white oil services. The first part deals with the causes, results, and costs of this corrosion, whilst the second half deals thoroughly with 3 methods of combating it. These are cathodic protection, coating with epoxy resins, and use of corrosion inhibitors. In conclusion, the author gives recommendations of the type of protection to be used, under different conditions, for both black and white oil services. E. M. I.

ENGINES AND AUTOMOTIVE EQUIPMENT

2248. Carbon monoxide formation in gasoline-driven vehicles. M. Brunner. *Schweiz. Arch. angew. Wiss.*, 1958, **24**, 177–88.—CO content (2–3%) of exhaust gas at part load (*ca* 30 m.p.h., top gear, on the level) is *ca* ½–⅓ of figure 20–30 years ago. Effect of climbing, indirect gears, and especially altitude (increase of *ca* 25% for every 500 m rise) is considered. Overall increase of CO emission by factor of 6 or more can occur when climbing on indirect gears at high altitude, with consequent influence on ventilation system design in Alpine road tunnels. V. B.

SAFETY PRECAUTIONS

2249. Petrol-vapour poisoning. R. Aidin. *Brit. med. J.*, 1958, *ii*, 369–70.—Fatal case reported resulting from sampling open-ended 40-gal drum (*ca* ¼ full) containing petrol (characteristics not given). Subsequent tests (Poole combustimeter) suggested that inhaled vapour might have been at concn of *ca* 2%. Post-mortem findings showed no specific pathological changes; literature is reviewed. V. B.

2250. Accidents involving petroleum. Anon. *Petrol. Times*, 15.8.58, **62** (1592), 707.—Report of H.M. Inspector of Explosives for year ended 31 Dec. 1957 is briefly reviewed. G. A. C.

ECONOMICS AND MARKETING

2251. For a change in "works price" in refining industry. A. Migdal. *Nafta* (*Krakow*), 1958, **14**, 23–5.—Growing participation of the workers in the running of their works gives rise to the need for explaining why certain refineries are uneconomical: prices determined on the overall or national average costs resulted in the Jaslo refinery running at a loss in 1956. The paradox of the situation lies in the fact that Jaslo is one of the more modern units. On the other hand, highest profits were shown by the Trzebinia refinery, which is not only modern but also the largest in Poland. Since the crews have no say in the choice of raw materials and their profit participation schemes depend on it, it is obvious that prices should be worked out on a basis other than heretofore. M. S.

2252. Achievements and aims of petroleum industry. Z. Zborowski. *Nafta* (*Krakow*), 1958, **14**, 1–4.—Speaking in Krakow on 3 Dec. 1957 the author gave the following approx figures for the whole year. Crude = 181,000 tons (3·4% above plan), natural gas = 411 million cu. m. (0·2%); from this, gasoline = 16,120 tons (0·1%). Processing = 100·5% of plan, drilling = 102·5%. In Jedlicze a solvent refining plant, capacity 36,000 tons p.a.; at Jaslo an asphalt blowing plant capacity 18,000 tons p.a.; and at Trzebinia a fuel refining plant, capacity 50,000 tons p.a., were started in 1957. Polish refineries with total capacity 750,000 tons p.a. produce enough to cover 43% of the national consumption of 1·8 million tons p.a. When the refining capacity is expanded to 900,000 tons p.a. by 1961, consumption is planned to rise to 2·7 million tons p.a. Plans for 1975 envisage consumption of 7·5 million tons p.a.

M. S.

MISCELLANEOUS

2253. 1957 and its implications for the oil industry. J. S. Senior. *Inst. Petrol. Rev.*, 1958, **12** (138), 203–8.—A general economic survey discussing the effects of the Suez emergency, the present tanker situation, production in the Middle East, the U.S. supply position, consumption in the U.K., and future prospects. Suez did not seriously affect European economy, due mainly to reserves and a mild winter. It did, however, indicate the advantage of large tankers, and 2 tables indicate improvement in the tanker situation in 1957. Middle East production fell, but 1957 has seen new agreements. In the U.S.A. demand fell in the second quarter and the effect of the recession was felt later, prices falling steadily. Demand was only down 2% in the U.K., despite restrictions. 3 figs.

E. M. I.

2254. Some aspects of the supply of petroleum products to the [French] navy. M. Morel. *Bull. Ass. franç. Tech. Pétrole*, 1958, 395–409.—Main requirements (1957) were fuel (75 cS/50° C) 185,000 tons; gas oil (S 1%, pour −10° C) 65,000 tons; aviation fuels 60,000 m³; automotive fuels 10,000 m³; lubricants 2750 tons. In contrast to pre-war position supplies are now almost entirely from French refineries. V. B.

2255. Applied hydrocarbon thermodynamics. Pt 4. Compressibility factors and equations of state. W. C. Edmister. *Petrol. Refin.*, 1958, **37** (4), 173–9.—Specific vol or densities of vapours and liq are frequently estimated from generalized correlations of compressibility factor plotted against reduced pressure and temp. Empirical equations of state are also used for this purpose. The author deals with an improved compressibility factor correlation, using the acentric factor. In this way he shows that a more convenient and accurate way exists for estimating the compressibility factor and deriving thermodynamic properties for any substance. The more recent equation of state developments are also discussed as a means for correlating P–V–T data. J. R. T.

2256. Applied hydrocarbon thermodynamics. Pt 5. Thermal expansion factors of petroleum liquid. W. C. Edmister and W. S. Hanna. *Petrol. Refin.*, 1958, **37** (5), 227–33.—Liquid phase densities are frequently calculated from a reference density and an expansion factor. The authors show that in the case of petroleum fractions the "Jessup's Modulus Method" is more convenient than the conventional correlations. The theory of the method, including all the necessary modifications for temp and pressure, is dealt with concisely. Typical charts to cover the theory are also presented, together with a simple calculation. The overall accuracy of the method compared with previous observations is shown to be very good. J. R. T.

BOOK REVIEW

Proceedings of the Congress on Modern Analytical Chemistry in Industry. Cambridge: W. Heffer & Sons Ltd., for the Society for Analytical Chemistry, 1958. Pp. vii + 244. 42*s*.

A Congress on Modern Analytical Chemistry in Industry organized by the Scottish Section of the Society for Analytical Chemistry was held at the University of St Andrews during 24–28 June 1957, and the proceedings and summaries of the discussions have since been published by W. Heffer & Sons Ltd, Cambridge.

The work of the Congress was divided into three sections, the first dealing with " Analysis in Modern Industry " (seven papers and one lecture), the second with " Applications of some Newer Analytical Techniques in Industry " (eight papers and one lecture), while the third was entitled " Developments in Analysis for New Problems in Industry " (five papers and one lecture).

Analytical fields applicable to many different industries (electrical, food, gas, iron and steel, petroleum, plastics, and rare metals) are discussed in the papers and the analytical activities of well-known laboratory organizations (DSIR, Government Chemist, etc.) are described.

All the papers are of high technical quality and well warrant study, particularly by those engaged in analytical research. W. H. T.

ADDITIONS TO THE LIBRARY

Entries are arranged in subject order according to the Uren " Classification for Petroleum Bibliography," the number preceding each entry indicating the classification and corresponding to that used in the " Library Catalogue " published by the Institute.

080 THE DIRECTORY OF DIRECTORS 1957. London, Thomas Skinner (1956). 896 p.

080 GREINER, Emil, Co. *publishers*. Laboratory equipment and apparatus. New York, Emil Greiner Co., 1958. 878 p.

090 AMERICAN PETROLEUM INSTITUTE. Specification for bolted production tanks. 11th edition. New York, API, 1958. 21 p. (STD 12B.)

090 AMERICAN PETROLEUM INSTITUTE. Specification for casing, tubing, and drill pipe. 22nd edition. New York, API, 1958. 47 p. (STD 5A.)

090 AMERICAN PETROLEUM INSTITUTE. Specification for high-test line pipe. 8th edition. New York, API, 1958. 23 p. (STD 5LX.)

090 AMERICAN PETROLEUM INSTITUTE. Specification for line pipe. 17th edition. New York, API, 1958. 39 p. (STD 5L.)

090 AMERICAN PETROLEUM INSTITUTE. Specification for oil-field flat belting. New York, API, 1957. 31 p. (STD 1A.)

090 AMERICAN PETROLEUM INSTITUTE. Specification for oil-field V-belting. New York, API, 1957. 31 p. (STD 1B.)

090 AMERICAN PETROLEUM INSTITUTE. Specification for oil-well cements. 5th edition. New York, API, 1958. 11 p. (STD 10A.)

090 AMERICAN PETROLEUM INSTITUTE. Specification for ring-joint flanges for drilling and production service for extreme pressures. (Tentative.) New York, API, 1958. 8 p. (STD 6BX.)

090 AMERICAN PETROLEUM INSTITUTE. Specification for rotary drilling equipment. 14th edition. New York, API, 1958. 50 p. (STD 7.)

090 AMERICAN PETROLEUM INSTITUTE. Specification for welded oil storage tanks. 15th edition. New York, API, 1958. 80 p. (STD 12C.)

090 AMERICAN PETROLEUM INSTITUTE. Specification for wellhead and drilling-through equipment. 5th edition. New York, API, 1958. 22 p. (STD 6E.)

140 FINNIE, R. Bechtel in Arab lands. San Francisco, Bechtel Corporation, 1958. 149 p.

540 BECHER, P. Emulsions: theory and practice. New York, Reinhold, 1957. 382 p.

750 DONALDSON, N. The chemistry and technology of naphthalene compounds. London, Edward Arnold, 1958. 512 p.

870 HATCH, L. H. Higher OXO alchohols. New York, John Wiley, 1957. 120 p.

930 GALLIARD, J. Industrial standardization. New York, H. W. Wilson, 1934. 123 p.

970 ZIMMERMANN, E. W. Conservation in the production of petroleum: a study in industrial control. New Haven, Yale University Press, 1957. 417 p.

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OILFIELD EXPLORATION AND EXPLOITATION

GEOLOGY

2257. Eastern Gulf Coast oil and gas geology. J. Braunstein. *World Oil*, 1958, **146** (7), 133.—The Eastern Gulf Coast region comprises Mississippi, Florida, and parts of Alabama and Georgia, and it contains a number of important positive and negative areas. The most important basin is the Mississippi salt basin, which can be sub-divided into subsidiary basins within which 48 shallow salt domes have been found by drilling. Three of these have given small amounts of gas and two have produced oil. S. of this area there is a line of important fields which produce from Upper Cretaceous Tuscaloosa sands. These tend to be lenticular, and the traps are structural, modified by stratigraphy.

Along the N. edge of the shallow salt basin are the Upper Cretaceous Eutaw fields located along a fault trend where there is good sand development and salt uplifts.

There are two Palæozoic basins in the region, the Black Warrior basin, N. of the salt dome area, where a few minor gas fields have been found in Upper Mississippian sands in

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fault structures, and the Suwannee basin, which lies mainly in N. Florida, where there are Cambrian to Devonian beds which have so far proved barren.

In the SE. Gulf Coast there are Lower Eocene Wilcox fields, mainly located in SW. Mississippi; the Jurassic is also productive. 18 refs. C. A. F.

2258. Frio trend offers good prospects. R. B. Johnson and H. E. Mathy. *World Oil*, 1958, **146** (7), 141.—Since the discovery of the Refugio field in 1928 there has been much drilling in the Frio trend in S. Texas, and large structures have been outlined in which accumulations are mainly due to facies changes and down-to-the-coast faults. The stratigraphy and structure of the trend are briefly described, and it is shown that the Frio consists of a phase of many transgressions and regressions within which there is a zone of max sand development which parallels the present coast line. The best sand conditions are along the downthrown side of the Vicksburg flexure. Reservoir conditions are better northwards along strike, where marine sediments predominate.

Future prospects of the area are good. Nine refs.

C. A. F.

2259. Eastern Erg, and its reconnaissance by helicopter. (In French.) P. Jacquemont. *Bull. Ass. franç. Pétrole*, May 1958, 193–211.—The Great Eastern Erg is one of the most important sand-covered areas in the Sahara, and the surface is such as to make conventional means of travel difficult. The N. and W. are well known, but the SE. has had little reconnaissance. There are records of a few journeys since 1860.

The army has compiled a map (included) showing the distribution of the main surface features. Aerial photographs are appended to show some of these features.

A dozen helicopter flights were made in 23 days, the mean duration being *ca* 3½ hr. 78 isolated outcrops were visited. Future operations should have more equipment. The operation provided valuable experience. G. D. H.

2260. The Noumea and Bourail basins (New Caledonia). (In French.) B. Tissot and A. Noesmoen. *Rev. Inst. franç. Pétrole*, 1958, **13** (5), 739–60.—Rocks ranging in age from the Permian or earlier to the Eocene are known. The Trias and Jurassic are transgressive on the Permian; there is a post-Jurassic break with Cretaceous deposits which include coals following and showing two zones, which feature is present in the Eocene, a formation which transgresses on to the Trias or Jurassic. Over 3000 m of Upper Eocene occurs. Information on the lithology, thickness, and occurrence of the formations is set out. There is good correlation of the Eocene with beds in New Zealand and New Guinea. There are igneous rocks as well as sediments.

The rigid Permian basement shows faults and fractures, the Trias and Jurassic having similar features. In the internal zone the plasticity of the Cretaceous is an important factor, but this formation is absent in the external zone. The latter zone has moderate dips and straight regular folds; isoclinal folds and other complexities occur in the internal zone; a third zone is made up of serpentines and metamorphics.

Overthrusts separate the external and internal zones.

Only a part of the basins of Noumea and Bourail is of interest as regards oil. Source rocks seem rare; possible reservoir rocks are rare or absent, for the sandy Cretaceous is not known in any part of the visible external zone. The Gouaro anticline of the Bourail basin is not closed. Wells Gouaro 1 and 2 showed a little gas and traces of oil. No closed and little disturbed folds have been indicated in the Noumea basin. The oil prospects of New Caledonia seem very limited.

Maps and sections are included. G. D. H.

2261. Geochemical studies of some hydrocarbon shows in the Jura–Savoie region. (In French.) M. Louis and F. Brienner. *Rev. Inst. franç. Pétrole*, 1958, **13** (3), 199–207.—Bituminous shows from the Molasse, Urgonian, and Berriasian of Savoie, Isere, Ain, and the Swiss Jura were studied. Carbenes, asphaltenes, resins, and the oily constituents were determined where possible, together with the elementary composition of the oily constituents.

It appears that in the Molasse there is oil of mixed base, in the Urgonian a somewhat naphthenic oil, known only from its alteration products, and in the Berriasian a paraffinic oil. The Volant quarry exploits a bituminous Urgonian limestone overlain by impregnated Molasse sands; these hydrocarbons seem to be from a single unknown source. The bitumen of Val-de-Travers is similar, and the two may have had a common source rock. G. D. H.

2262. Tertiary movements in Emlichheim oilfield. (In German.) R. Kram. *Erdöl u. Kohle*, 1957, **10**, 567–70.—Investigations show that—in the Emlichheim region—formation of the Emlicheim–Schoonebeek anticline was ended at the beginning of the Tertiary. However, in contrast to other Emsland fields, during the Tertiary, still intensive tectonic movements occurred which led to a division of the structure into individual steep hercynian-running fault blocks. These movements were conc in three periods: Upper Eocene/Lower Oligocene, Upper Oligocene/Lower Miocene, and higher Middle Miocene or still younger.

(Author's abstract.)

2263. Classification of the German Alpine foreland molasse with the aid of seismic velocities. (In German.) H. John. *Erdöl u. Kohle*, 1957, **10**, 493–6, 570–3, 661–4.—Pt 1. Problem setting; measuring data; thickness distributions; velocity distributions. Pt 2. Reduction diagram; frequency distribution of reduced velocities. Pt 3. Reducing velocity fields; abstract.—Pt 1. Designation of equiv substages of deposited Miocene and Oligocene runs: in W. (limnish-fluvialite) upper fresh water molasse (OSM); upper sea molasse (OMM); lower fresh water molasse (USM)—including building stone strata a petroleum source—lower sea molasse (UMM). In E. (marine) Pont to Tortonian; Helvetian and Burdigal; Aquitanian and Chatt; Rupelian and Lattorfian. As petroleum sources building stone strata were surveyed additionally. Velocity analyses are given for the whole molasse and separately for the above four stockworks with supporting related isopac maps. Thereby, the regularity of the hanging pressure influence on velocity increase with thickness increase is the chief problem. Along with the hanging pressure also considerable lithological influences of variable type must have assisted in the velocity configuration. Pt 2. A so-called reduction diagram, consisting of a group of velocity–depth curves, presents results of the analysis. With the help of the diagram—according to the depth position—the varying hanging pressure influence in the measured val was eliminated by reducing the measured val to the earth's surface. These lithological velocity val were compiled in a summary of the individual substages of the molasse and discussed. The diagram—valid only for the molasse—gives the regularity of the velocity increase as a function of depth for different sound-hard materials. These surveys exhibit—for the individual strata and spaces of the molasse—typical maxima, and give therewith a spectral picture of the sp sound-hardness. Thereby it proved expedient to characterize these maxima not only through respective velocity intervals, but also to name them after the regions of their predominant distribution as Bavarian, Bavarian–Swabian, Swabian, Swabian–Swiss, and Swiss. Pt 3. The reduced lithological velocity val compiled in a summary of the individual molasse stages are discussed. In the discussion of the geological data as a

hypothesis for the existence of the typical velocity fields for the molasse—along with the known flows and possible hardenings by cementation—also influences of variable erosion and ice covering are treated. R. T.

GEOPHYSICS AND GEOCHEMICAL PROSPECTING

2264. Geodetic—magnetic survey aids Guatemala exploration. H. T. Brundage. *World Oil*, 1958, **146** (6), 205.—An airborne magnetic survey has been carried out in Guatemala using Shoran for location finding. This is the first time the method has been used in aerial magnetic work, and ground control points are now available for local concessions. Shoran has been invaluable in surveying prospective areas of the country where there are jungle conditions and poor communications. The cost of the survey was *ca* $\frac{1}{2}$ million, covering *ca* 15,600 sq. miles. Ground geophysical surveys have been carried out in the Puerto Barrios–Livingstone area, and core drilling in the region is reported. Further drilling is planned. C. A. F.

2265. Examples of seismic (refraction) recording. (In French.) P. Dunoyer and H. Richard. *Bull. Ass. franç. Tech. Pétrole*, May 1958, 213–28.—Refraction work has in recent years given excellent results in the Sahara. Refraction gives a spectrum rich in low frequencies.

A number of seismograms are given and used to illustrate a series of points: simple wave interference, arc shooting, the use of apparatus adjusted to take very low frequencies, and diffraction. G. D. H.

2266. Geophysical activity in the French Union during recent years (its evolution and trends). (In French.) P. Moussel. *Bull. Ass. franç. Tech. Pétrole*, May 1958, 247–61.—Since 1950 the use of geophysical work in the French Union, Morocco, and Tunis shows a progressive rise for seismic work from 98 party-months to 722 party-months in 1957; magnetic work rose from 10 party-months in 1950 to 52 in 1955, and this was also the peak year for gravity work (149 party-months). Over these years French geophysical activity in party-months has been roughly half the total for OECE. Seismic work has remained roughly constant in amount in Germany; it has shown oscillations at a lower level in Italy; but in France it has grown progressively, attaining a level comparable with that in Italy. Activity in Metropolitan France and overseas has shown similar growth, with substantial rises since 1954. Although activity in N. Africa has fallen since 1951, there have been marked rises on the Sahara and other overseas areas. In France, Aquitaine and the Paris basin have had marked increases in activity in recent years.

A breakdown of activity in 1950–57 according to areas shows Aquitaine to have had 677 party-months of seismic work and the Sahara 505 party-months; the latter area led all others in gravity and magnetic work. Seismic work accounted for three-quarters of the total party-months. 22,800 million Fr. were spent in France, and 48,800 million Fr. overseas. Geophysics accounts for 35% of exploration costs and drilling 50%. G. D. H.

DRILLING

2267. Simultaneous drilling: a radical new method for drilling development wells. W. A. Theriot. *J. Petrol. Tech.*, 1958, **10** (4), 13–16.—Simultaneous drilling is a means of drilling two directional holes alternately from a single rig with only one crew. It was originally used with turbo-drills. Drill-pipe taken out of one hole is run with a bit down the other hole. The rig floor is larger than usual to take the second rotary table. A single crown and travelling block can be moved on a geared track. There are two mud systems with one set of pumps. Wear on drill-pipe is more even.

The inactive hole is left standing idle for considerable periods, with certain risks. Crews are used more effectively, but there must be max co-operation and co-ordination.

The method of operation is described. Spare drill-pipe can be left in the cased part of the deeper hole and removed as needed. Surveys may be made in one hole while drilling proceeds in the other. In some cases rotation on slips and circulation may proceed while casing is being run in the other hole. Conventional round trips may be made while cement sets in one hole.

Time saved by simultaneous drilling increases with depth until a point is reached where disadvantages off-set advantages. *Ca* 60% of trip time could be saved by simultaneous drilling. 90% of wireline work could be done while drilling. Most of cementing and waiting time would be saved. It is estimated that an 11,000-ft offshore well would need 107 days conventionally and 71 days for simultaneous drilling; potential savings are $500,000/well. G. D. H.

2268. Use of chemicals to maintain clear water for drilling. J. P. Gallus, J. L. Lummus, and J. E. Fox. *J. Petrol. Tech.*, 1958, **10** (4), AIMME Tech. Paper No. 8008, 70–5.—In some areas the formations are such as to allow drilling with water, with improved drilling rates and other advantages, but there is the practical problem of maintaining clear water by purely mechanical means. It has been found that fresh water or brine with less than 5% by weight of clay solids can be kept clear by adding water-soluble acrylamide–carboxylic acid copolymer at the flow-line at the rate of 0·0175–0·175 lb of polymer/brl of fluid. The polymer soln reduced the permeability of lab specimens to water by 90–98% without giving visible filter cakes, but the permeability of oil-bearing formations to oil was not impaired. The loss of water to permeable formations without fractures or vugs was kept low by adding 1–4 lb of polymer/hr at the pump suction. Field tests showed improved drilling rates, less bit wear, and lower mud costs. G. D. H.

2269. Double shut-in drill stem tests. B. R. Dixon. *World Oil*, 1958, **146** (7), 191.—The double shut-in drill stem test enables the max reservoir formation pressure to be built up in the shortest time. The procedure gives two pressure build-ups: an "initial shut-in" before flow and a "final shut-in" after flow. Comparison of both pressures can give information about permeability.

Limited fluid withdrawal is required for the initial shut-in procedure, and this is obtained by means of a disk valve in the tool which is placed above the main valve. This enables a specific vol of air to be trapped between the two valves. After the packer is set the main valve is opened, the trapped mud pressure is bled off into the air trap, and the formation can produce to a limited extent controlled by the trap. An air trap vol of *ca* 10% of the mud vol below the packer has given generally favourable results. The interpretation of typical double shut-in charts is discussed with diagrams. C. A. F.

2270. Effect of pressure on rock drillability. J. R. Eckel. *J. Petrol. Tech.*, 1958, **10** (1), AIMME Tech. Paper No. 4702, 1–6.—The lab equipment can use circulating mud on water at pressures up to 5000 p.s.i., or use earth or pore pressure applied by separate systems. Load and bit speed are variable; air can be circulated. Diamond bits and $1\frac{1}{4}$-inch two-cone micro-bits were used. Quarry stone and core samples have been drilled. Resin jackets on the outside separate the applied pressures; the bare ends receive hydrostatic and formation pressures.

Tests of the effects of weight on bit, rotary speed, and

circulation rate gave results agreeing qualitatively with field data. With air or water as drilling fluid limestone drilled most rapidly when the hydrostatic and formation pressures were the same. Hole cleaning is important. Air favourably affected limestone drilling rate only when compared with water at high hydrostatic pressures, other conditions being constant.

Marked drilling rate increases were obtained on shale using air.

Usually changes due to pressure were small compared with changes in drilling rate due to bit load or rotary speed.

G. D. H.

2271. Departure curves for the self-potential log. A. E. Worthington and R. F. Meldon. *J. Petrol. Tech.*, 1958, **10** (1), AIMME Tech. Paper No. 4701, 11–16.—$SP = b_e E_e - b_k E_k$, where SP is observed self-potential opposite the centre of the bed, E_e electrochemical potential, E_k electrokinetic potential, b_e electrochemical reduction factor, and b_k electrokinetic reduction factor. This allows for geometric and resistivity effects, and for streaming potential. The Guyod analogue computer was employed in making the basic studies. This has a two-dimensional mesh of resistors, representing vertical and horizontal distances relative to the borehole.

Reproducibility was examined, and checks of Doll's analytical studies agreed within 2%. Sonde dia effects were examined. Formation factors corresponding to porosities of 10–35% were used; e/d ranged 2–30, D_i/d 1–9·6, R_i/R_m 0·2–150, R_i/R_m 6–105, and R_i/R_t 0·6–30. The results are presented as departure curves. b_e and b_k fall markedly with decreasing e/d; b_e decreases with increasing D_i/d; b_e and b_k fall with increasing R_i/R_m. G. D. H.

2272. "Big eye" bit. E. McGhee. *Oil Gas J.*, 7.7.58, **56** (27), 131–4.—A three-cone jet-bit with one jet oversize can be used for deviating holes without a whipstock in soft formations. Common jet sizes used are two $\frac{3}{4}$-inch and one $\frac{3}{4}$-inch. The large vol of fluid passing through the large jet tends to wash out the hole adjacent to it if the bit is held stationary, but even cutting is obtained if the bit is rotated in the usual way. Deviation is therefore obtained by locking the rotary table with the large jet orientated in the desired direction when the appropriate depth is reached. Mud circulation is continued and the bit gently spudded. In a typical operation 10 ft of hole can be washed down and a deviation of 3°–4° secured in 15 minutes, after which rotation is resumed and drilling continued in the normal way. No round trips are necessary. This method has been used successfully in nearly 100 wells, especially in off-shore Louisiana, at deviation depths of down to 6000 ft. J. C. M. T.

2273. Recent improvements in air drilling techniques. M. M. Brantly. *World Oil*, 1958, **146** (6), 140.—The use of air as a circulation medium instead of mud can increase rate of penetration in drilling and bit life, but it has introduced several problems which have been studied in the lab and the field. Dust control at the well head can be a serious problem, but this can be controlled by a water spray at the end of the flow line. Although it has been claimed that air drilling can cause hole deviation, this can be avoided by adjusting bit weight. Water entry is a serious problem, but some new materials have been developed to seal off zones without using cement; these include resins and a low visc liq which sets as a gel. Field tests of the gels have given encouraging results.

C. A. F.

2274. Foaming agents aid air drilling. R. M. Reed. *World Oil*, 1958, **146** (7), 149.—Foaming agents have been used in an air drilled well in Texas to study their effect in combating lost circulation. With their use it was found possible to handle large flows of water if there is no sloughing of formations, but the amount which can be tolerated is limited by the cost of the foaming agents and the reduced rate of penetration compared with straight air drilling. Penetration rates are, however, faster than mud drilling. The drilling history of the test well is given, and it is indicated that pipe corrosion can be a problem unless inhibitors are used. C. A. F.

2275. Plastic slurry, water gel used for water shut-off. Anon. *Drilling*, July 1958, **19** (9), 86.—Two new materials for the control of unwanted formation water during air or gas drilling have been developed by Halliburton Oil Well Cementing Co. One, designated PC.11, is a slurry incorporating a thermosetting plastic and solid bulking material; this is emplaced like cement, and setting takes place in 1–3 hr after contact with the formation water, the set material being nearly as hard as cement. This slurry is suitable for sealing off fractures or channels. The other material, PWG, is a polymeric water gel with a very low initial visc, which makes it suitable for controlling water from the true permeability of the formation. After emplacement it sets to a very stiff gel.

J. C. M. T.

2276. Drilling with salt water. J. P. Smith. *World Oil*, 1958, **146** (6), 150.—Two test wells in Illinois which used salt water as a circulating medium showed a higher penetration rate, lower drilling time, and fewer bits than in comparable mud-drilled wells. It is claimed that salt water without additives can give substantial savings in drilling costs in areas where it is applicable, particularly where there is a shortage of fresh water. To log the wells, a γ-ray curve can replace the SP curve, and guarded resistivity and contact logs can be run.

Factors which favour the use of salt water are: (1) rapid precipitation of solids from brine, and (2) its common occurrence in ample supply. The corrosive nature of the water should be examined. C. A. F.

2277. Drilling with a power swivel offshore. H. C. Morgan. *World Oil*, 1958, **146** (7), 161.—A well offshore from Louisiana has been drilled using a hydraulically powered swivel. This has the advantages of enabling a 90-ft stand of drill pipe to be drilled down, so eliminating the time needed for two connexions, and permitting rigs to be skidded across multi-well offshore drilling platforms.

The power swivel replaces the kelly joint and rotation is by hydraulic fluid motors which are mounted on the swivel and drive a sub-stem through gearing.

There were no unusual drilling problems, and results were encouraging; 7711 ft were drilled in 98 hr rotated. Max speed was 140 rev/min. A diagram shows the hydraulic circuit. C. A. F.

2278. Note on the use of turbo-drills with roller bits. (In French.) P. Labaste. *Rev. Inst. franç. Pétrole*, 1958, **13** (3), 208–12.—Turbo-drills use greater speeds of rotation than the rotary drill. Tests in the U.S.S.R. show that disaggregation increases with the speed of rotation, hard rocks requiring higher speeds than soft rocks, yet soft rocks need a larger couple. The rate of advance grows with increased weight on the bit to a max, and then falls sharply at greater weights. Rate of advance drops with increased hydrostatic pressure.

The rate of rotation of a turbine increases with pump output; the couple decreases linearly with increase in speed, and the power rises to a max, then falls. The practice is to use the speeds giving the max power. Max advance is obtained when max power is applied to the bit. The power transmitted to the turbine should be two-thirds of the hydraulic power of the pumps. The ratio of the optimum couple and

the optimum speed of rotation must be as high as possible; it depends on the dia and number of stages for a given flow, and the dia of the turbine should be as close to the hole size as is practicable. At great depths the flow must be reduced and the hydraulic pressure increased, or multi-stage turbines must be used, especially below 1500 m. Pipe of large dia is preferable, although tubing can replace drill-pipe.

Rotary bits function well with the turbo-drill. The speed of 600 rev/min causes kinetic energy to be important, and bits with wide teeth are best. Jet bits are poor.

The couple depends on the flow and density of the mud. G. D. H.

2279. Project turbo-drill. D. Schultz. *Drilling*, Aug. 1958, **19** (10), 77.—The turbo-drill is proving a satisfactory tool in the drilling of the Herscher, Illinois, gas storage reservoir. A special drilling problem is the requirement of large dia hole at shallow depth through hard and broken dolomites and sandstones, where it is impossible to apply sufficient weight to prevent severe bouncing when conventional drilling methods are used. This has been overcome by using the turbo-drill, which requires less bit-weight for a given penetration for the first 1440 ft. The completion of this section has been reduced from 16 days using conventional methods to three days with the turbo-drill. Below 1440 ft to total depth at 2550 ft ordinary rotary drilling is used, but advantage is taken of the high pump capacity available to employ jet bits. Total completion time with this programme is 10 days, against 30 days using conventional methods throughout, and the holes are now also straighter. J. C. M. T.

2280. Properties of cementing compositions at elevated temperatures and pressures. G. Carter and D. K. Smith. *J. Petrol. Tech.*, 1958, **10** (2), AIMME Tech. Paper No. 8001, 20–7.—A number of cement compositions have been examined at high temp, and 3000 p.s.i. pressure for strength behaviour for periods up to 180 days of curing. All except mixtures of pozzolans and hydrated lime showed mild to severe loss of strength at 230°–320° F after setting. Generally there was little loss between 7- and 90-day strengths at 290° and 320° F.

Some additives with certain compositions caused marked changes. Many strengths were thought still to be adequate for oil-well cementing, provided that other factors, such as mud contamination, do not interfere. Ilmenite and barytes caused no marked strength loss in 28 days at 290° or 320° F; bentonite and diatomaceous earth produced a large loss.

X-ray studies showed the presence of dicalcium silicate α-hydrate when there was most loss in strength, and this has little or no strength properties. Permeabilities were highest for the cases of large loss in strength. G. D. H.

2281. Advantages of liquid cyclone treatment of weighted muds. H. D. Mathis and R. L. O'Shields. *World Oil*, 1958, **146** (6), 134.—High mud weights, which are necessary in deep drilling, have led to the development of methods for mechanical treatment of weighted muds in which the drilled solids are removed. The use of the shale shaker and pit jetting with dilution are costly, because of the need to replace discarded mud components, but the use of a cyclone has proved very useful. This is similar to an air cyclone, slurry being introduced tagentially near the top, separation being effected by centrifugal action. Many design factors affect separation, and these have been determined experimentally. Tests have shown that a 50-minute liq cyclone removes 50–80% of clay solids and reclaims 75–90% of barite; and field operations have shown that the cyclone has several advantages, including the effective control of visc, mud weight, and clay/barite balance, and reduced mud costs due to salvage of barite.

Diagrams show the equipment and layout at the well. C. A. F.

PRODUCTION

2282. Application of a resistance network for studying mobility ratio effects. M. A. Nobles and H. B. Janzen. *J. Petrol. Tech.*, 1958, **10** (2), 60–2.—The basic unit had 840 resistors on a 36 × 36-inch Lucite sheet on a square pattern of 1½-inch spacing. Snap fasteners allowed several resistors to be stacked in parallel. This unit was one of four similar elements in a five-spot pattern. Current input represents injection and output production. Mobility ratio was assumed as the ratio of the conductivity ahead of the flood front to the conductivity behind. The front was advanced in five or six steps to break-through. 1- and 2-megohm resistors were used. The mobility ratios were ⅛, ¼, ½, 1, 2, 4, and 6.

Areal sweep efficiencies were found to increase with rise in mobility ratio. Differences of 1–2% from potentiometric results were noted. Plots of swept area *v.* nose advance resembled potentiometric data.

Finer meshes near wells would have given more accurate potential data. G. D. H.

2283. Model for the mechanism of oil recovery from the porous matrix due to water invasion in fractured reservoirs. J. S. Aronofsky, L. Masse, and S. G. Natanson. *J. Petrol. Tech.*, 1958, **10** (1), AIMME Tech. Paper No. 4703, 17–19.—The abstract model assumes that oil production from a small volume of porous oil-saturated rock is a continuous monotonic function of time, converging to a finite limit; that none of the properties affecting the rate of convergence change sufficiently during the process to affect the rate or the limit. The reservoir is supposed to consist of identical blocks stacked vertically and separated by fractures; each block satisfies the conditions for the abstract model. Oil production from any part of a block starts when water comes in contact with it.

Oil displacement may be by flow due to natural or artificial pressure gradients, and also by inbibition. In a much-fractured rock interchange between oil in the matrix and water in the fractures may become an important factor with time.

Mathematical aspects are presented, along with an application of the idea. G. D. H.

2284. Study of anomalous pressure build-up behaviour. G. L. Stegemeir and C. S. Matthews. *J. Petrol. Tech.*, 1958, **10** (2), AIMME Tech. Paper No. 8004, 44–50.—Studies of a series of wells for which the pressure build-up curves showed a hump suggested that segregation of gas from oil in the well bore after closing in was probably responsible for the phenomenon. Simple lab experiments gave comparable results. Calculations based on bubble-rise time confirmed the belief, as did observations on a well, involving accurate surface and bottom-hole pressure measurements.

Wells in many other fields have shown similar behaviour. Humps are most marked for formations of moderate permeability with some skin effect. However, tubing and packer leaks can cause similar humps. Measurement of surface tubing and casing pressures during build-up can aid in finding the cause. A device capable of shutting-in the well just above the bottom-hole bomb would remove these anomalies, and so allow the observations to be used for calculating permeability and stabilized build-up pressure. G. D. H.

2285. Process variables of *in situ* combustion. W. L. Martin, J. D. Alexander, and J. N. Dew. *J. Petrol. Tech.*, 1958, **10** (2), AIMME Tech. Paper No. 8002, 28–35.—*In situ* combustion as a means of oil recovery has been studied in sand-filled tubes. The crude oils ranged 10·9°–34·2° API. Semi-adiabatic conditions were maintained in the loose sand. Various factors were varied. For self-sustained combustion a temp of at least 600° F is needed. To give this a minimum air rate of 4 $ft^3/hr/ft^2$ is needed. The rate of combustion

advance is nearly proportional to the rate of air supply and inversely proportional to the amount of residual material deposited. The minimum rate of advance of the combustion front was 0·7 ft/day or less.

With 21·2° oil the oil saturation consumed was 5·5% of the pore vol; the minimum air requirement was 20 $ft^3/hr/ft^2$; the effect of air pressure was small for experiments with high combustion efficiencies.

The combustion advances by burning residual material. Some oil moves by dist and increased gas flow due to vaporization of water. The length of the combustion zone is small.

G. D. H.

2286. Effect of fluid-flow rate and viscosity on laboratory determinations of oil–water relative permeabilities. C. R. Landberg, L. S. Gournay, and R. F. Sippel. *J. Petrol. Tech.*, 1958, **10** (2), AIMME Tech. Paper No. 8003, 36–43.—Small core samples from several outcropping sandstones were used in the relative permeability studies, cobalt-60, iodine-131, and mercury-203 being used as radioactive tracers for measuring fluid saturations. Oil visc ranged 0·398 to 1·683 cP, and flow rates for each phase 2·5 to 140·6 ml/hr.

The relative permeabilities were a function of saturation only, and independent of flow rates, provided that there was no saturation gradient in the core due to boundary effect. The outlet boundary effect, calculated from capillary pressure data and the effective permeability of the non-wetting phase, agreed well with that obtained experimentally when only the non-wetting phase was flowing.

Details of the equipment are given, including the means for obtaining saturations. G. D. H.

2287. A graphical short-cut for gas appraisals. R. P. Schoemaker. *World Oil*, 1958, **146** (6), 177.—A graphical method for estimating gas reserves is presented, based on average data obtained from gas fields in Alberta. It is claimed that it can also be used for other areas provided simple corrections are applied. An evaluation chart has been constructed, using the fundamental ideal gas equations and assuming that the gas is produced only by expansion, there being no change in the original pore vol. This enables the gas-in-place (in M.c.f/acre-ft) to be computed for a given depth, for an average porosity of 20%, connate water 20%, and the average pressure gradient for the area. Examples of the use of the chart are given. C. A. F.

2288. Vertical fractures. P. B. Crawford and D. R. Wieland. *World Oil*, 1958, **146** (6), 166.—Potentiometric model studies have shown that a vertical fracture can increase the pattern conductivity so that flooding or cycling the reservoir can be carried out at higher rates, in spite of previous work which indicated that vertical fractures parallel to the flooding pattern might give a low sweep efficiency. Details of the model, which consisted of a tank of salt water, are given with the results of experiments in which several vertical fracture patterns were studied. Fractures extending *ca* 50% of the pattern length or width may give conductivity increases of 20–65%, depending on type and orientation of fracture. 3 refs. C. A. F.

2289. More efficient dual gas lift installations. H. W. Winkler. *World Oil*, 1958, **146** (6), 157.—The need for a proper selection of gas lift valve arrangements for dually completed wells (with common injection gas sources) is stressed. Correct installation can reduce costs and production problems, the types of flow valves and suggested installation being presented for a dual well under four different arrangements: (1) both zones continuous flow; (2) one zone continuous flow—one zone intermittent flow; (3) both zones intermittent flow; and (4) producing characteristics of either or both zones unknown. The fluid-operated, intermittent-pressure operated, and continuous flow valve are each considered. Retrievable type valves facilitate rapid change of type if required. 5 refs. C. A. F.

2290. Reservoir conditions control well completion practices. D. E. Fitzgerald. *World Oil*, 1958, **146** (6), 173.—Methods of well completion for different types of reservoir are presented. The need for early determination of the form of producing mechanism is stressed, the basic types being water drive, gas expansion drive, gas solution drive, and combination drive. In selecting the completion method these must be considered in relation to formation characteristics such as porosity, permeability, oil and water saturation, and rock composition. Diagrams show theoretical structures and the form of fluid levels during depletion. C. A. F.

2291. Incompatible waters can plug oil sands. R. W. Laird and A. F. Cogbill. *World Oil*, 1958, **146** (6), 188.—Intermingling of incompatible waters in the pores of a reservoir rock can cause precipitation of salts and plugging of the pores, with consequent reduction in effective permeability. This can occur when there is mixing of injected water with interstitial water. Lab tests have been carried out in which two incompatible waters have been injected simultaneously into cores, the rate of flow through the cores being measured until plugging was indicated. The samples were then sliced into smaller pieces and the permeability of each was measured. The precipitate was extracted and permeability again determined; the difference was a measure of the effect of the mixing of the waters. In five tests the average permeability decrease was 27·5%, but the solutions used were stronger than those usually found naturally (in order to take into account the time factor in intermingling). Details of the equipment are given. 5 refs. C. A. F.

2292. Determining oil lost by an expanding gas cap reservoir. F. W. Cole. *World Oil*, 1958, **146** (6), 193.—The amount of oil lost by an expanding gas cap can be computed from material balance. The net change in gas cap vol is:

$$Gv_o\left(\frac{v}{v_o}-1\right)$$

where G = original gas cap size (standard cu. ft.);
v_o = conversion factor at original pressure (brl/standard cu. ft.);
v = conversion factor at any subsequent pressure (brl/standard cu. ft.).

By subtracting from this the free gas production, to give the net gas cap expansion, *i.e.* the gas invasion into the original oil zone, the amount of oil lost will be:

$$\left[Gv_o\left(\frac{v}{v_o}-1\right)-gv\right]\left[\frac{S_{og}-S_{ow}}{\beta S_o}\right]$$

where g = vol gas produced (standard cu. ft.);
S_{og} = residual oil saturation due to expanding gas (fraction);
S_{ow} = residual oil saturation due to water encroachment (fraction);
β = formation vol factor;
S_o = oil saturation in oil zone. C. A. F.

2293. Calculation of water entry and prediction of the pressure for a water-drive reservoir. (In French.) A. Chueca. *Rev. Inst. franç. Pétrole*, 1958, **13** (3), 22–45.—Water entry can be obtained from the relationships for transient flow, and allowance made for the case where the system is not a complete circular radial one. Material balance calculations will also give water entry.

For the past producing history there are theoretically two methods for finding water entry. From the transient flow relationships it is possible to evaluate the product of a

significant group of physical factors which may not be known individually with sufficient precision for direct calculation of the product. This product will usually have fairly constant values after an initial period where irregularities arise because of errors in pressure decline observations. Subsequently, predictions of future pressures and water entry may be made by trial and error, the aim being agreement of the water advance figures for both material balance and transient flow equations.

Relationships for fluid flow are of forms comparable with those for the behaviour of electricity, and so electrical circuits can be designed to match reservoirs. Note can be taken of the concentric zones around a field and even of the existence of fractures and matrix in the field.

Various relationships are plotted, and tables give the layout and results of calculations using the principles discussed.

G. D. H.

2294. Evolution of the surface-active characteristics of various wetting agents; influence of temperature. (In French.) C. Labbé. *Rev. Inst. franç. Pétrole*, 1958, **13** (3), 213–21.—Various wetting agents have been investigated in an acid medium (150 g HCl/litre) at 80° C. The change in surface properties after 5 hr was determined, with and without filtration. Both non-ionic and anionic substances were used. The speed of degradation of four products was examined. Rise in temp accelerates degradation.

The properties required in practice differ with the operation, and with the nature of the reservoir rock, the crude, and the formation water. There is at present no universal or perfect wetting agent. In acid treatment there must be stability at formation temp in the presence of acid and soluble salts of Ca and Mg. Non-ionic substances are indicated, such as the condensation of an alkylene oxide on a phenolic nucleus or on an alcohol.

For flooding the agent will depend on the rock type. Anionic and non-ionic cpds may be usable in sands and sandstones, whereas substances with a strong acid radicle cannot be used in limestone and dolomites. For fracturing it may be necessary to form a water-in-oil emulsion.

Non-ionic products, being stable in all the media, can be used on all occasions, although the commercial products are often inferior in activity to commercial anionic substances. Improvements in the former are therefore needed.

G. D. H.

2295. New approach toward elimination of slug in shaped charge perforating. J. Delacour, M. P. Lebourg, and W. T. Bell. *J. Petrol. Tech.*, 1958, **10** (3), 15–18.—The slug or carrot of metal arising from the cone in a shaped charge is a feature of many commercial shaped charges which are otherwise satisfactory. Tests under simulated down-hole conditions show that serious perforation plugging often occurs because the slug enters the perforation.

Theoretical consideration of the action of shaped charges and X-ray studies have thrown light on plug formation. Many attempts to reduce slug formation have reduced effectiveness of the charges in other directions. However, a bimetallic cone with zinc outside copper reduces slug, because heat vaporizes the zinc. Tests under simulated well conditions show that no slug remains in the perforation, and the charge has the high performance of the conventional charge with a copper cone. The flow indexes were higher in the former case, and the slug was found in the gun; in the latter case the slug was in the perforation. G. D. H.

2296. Pressure measurements during formation fracturing operations. J. K. Godbey and H. D. Hodges. *J. Petrol. Tech.*, 1958, **10** (3), AIMME Tech. Paper No. 8007, 65–9.—Various factors in fracture treatment prevent well-head pressures being an accurate index of bottom-hole pressures. The two pressure records allow better deductions about the nature of the fractures.

Pressure records were made during six attempted fracturing operations. In four cases the fracture seemingly occurred in the initial pressure surge with only crude oil in the well. One suggests the formation of limited fractures. The curves show: max pressure exerted on the formation, a rapid drop implying fracturing; passage of the various fluid interfaces into the formations; pressure loss due to flow; whether improved permeability was maintained. The surface pressure does not show some of the features which in the subsurface record are valuable. Long fluid columns damp the surface fluctuations. G. D. H.

2297. Evidence of chromatographic effect during flow of gases through oilfield cores. W. A. Roper, T. Doscher, and R. Kobayashi. *J. Petrol. Tech.*, 1958, **10** (3), 61–3.—A Ventura core, granulated Ventura core with 4% of Ventura crude, Torpedo sandstone, and Torpedo sandstone with 8·86% Ventura crude were used, generally for elution-type tests with methane–propane eluted by He. Extracted Torpedo sandstone gave no separation, but when oil was present there was a methane peak followed by a propane peak. There was slight separation in the weathered Ventura core; separate peaks were seen with the crushed core with oil. A frontal drive with the crushed core with oil had methane in the leading edge.

Corrected retention times and vol have been calculated, using the principles applied to analytical columns.

G. D. H.

2298. Pore volume compressibilities of sandstone reservoir rocks. I. Fatt. *J. Petrol. Tech.*, 1958, **10** (3), 64–6.—14 1-inch dia, 2- to 3-inch long oil sandstone cores and some other plugs were cleaned, jacketed in thick copper foil, and then subjected to an external pressure of 10,000 p.s.i.g. at 72° F. Kerosine in the pores moved a mercury index on vol change. With a constant 12,000 p.s.i.g. external pressure the internal pressure was raised in 1000 p.s.i. steps to 10,000 p.s.i.g. with reading of pore vol changes. Comparable observations were made with 6000 p.s.i.g. external pressure and a similar internal max. Soft high-porosity sandstones usually showed hysteresis.

Plots were made of pore vol compressibility against net overburden pressure (external pressure minus 85% of internal pressure). Accuracy was *ca* ±15%, and reproducibility of pore vol data *ca* ±5%. Graphical differentiation increased the uncertainty. At a given pressure sandstones may vary four-fold in pore vol compressibility. Well sorted sandstones with 10–30% cement and intergranular detritus showed smaller values than poorly sorted sandstones. There was no correlation with porosity (there were no high porosity specimens). G. D. H.

2299. Apparatus and methods used at the Institut Français du Pétrole for calibrating pressure bombs. (In French.) J. Pacsirszky. *Rev. Inst. franç. Pétrole*, 1958, **13** (5), 761–6.—The apparatus can be used at pressures up to 700 kg/cm² and temp up to 100° C. Pressure is applied in a manner equivalent to well conditions, for it has been shown that differences of *ca* 0·1% can occur when pressure is applied directly to the sensitive element and not to the apparatus as a whole.

The apparatus is described briefly, together with the manner of use. An example of the calibration of a pressure bomb is given, together with the calculations. G. D. H.

2300. Report on the displacement log. R. H. Winn. *J. Petrol. Tech.*, 1958, **10** (2), 57–9.—Halliburton developed a logging system to record simultaneously and continuously eight lateral curves. 16, 24, 32, 40, 48, 56, 64, and 72-inch

spacing was used, with flexible rubber bumpers to reduce the shunting effect of the hole and mud.

A mechanical reader was devised to resolve the log into the profile form needed to show the presence or absence of a dip, but the operation is still tedious, even with a scale of 1 inch log = 4 ft hole.

In 11 wells with 21 known productive zones 13 zones showed a low on the profiles. As a result of a good dip in a profile log a zone was tested, giving 62 b.d. oil with no water, although the true resistivity was *ca* 1 ohm/m. In one case the low was seen in only the top 7 ft of 21 ft of productive sand, presumably due to change with time.

A well showed a good dip on several profiles, yet a test gave 100% salt water.

Bumpers are essential, but create operational problems. Mechanically-controlled variable-dia bumpers may be needed. G. D. H.

2301. Non-plugging emulsions useful as completion and well-servicing fluids. G. G. Priest and T. O. Allen. *J. Petrol. Tech.*, 1958, **10** (3), 11–14.—Oil-in-water emulsions with diesel oil or tetrachloroethylene, or mixtures of these in $CaCl_2$ soln stabilized by lignosulphonates were used. They were stable for 24 hr or more at 250° F, and had filtration rates of 26–36 ml API at 250° F. Corrosion rates with an inhibitor present were negligible.

In the field they were used as perforating fluids for single and dual completions; they were also tested as well-servicing fluids. In 160 perforating jobs the wells flowed more readily or required less swabbing and cleaned up faster or had better potentials when emulsions were used. In servicing emulsions have been used to cover perforations, and they remove some of the risks present when salt water is so used; risks of blow-outs were reduced.

The mixing of muds with emulsions should be avoided; mixing thickens the mud. A 500-ft water layer is used. Cement slurries flash set on contact with $CaCl_2$. G. D. H.

2302. Factors affecting rate of deposition of cement in unfractured perforations during squeeze-cementing operations. G. W. Binkley, G. K. Dumbauld, and R. E. Collins. *J. Petrol. Tech.*, 1958, **10** (3), AIMME Tech. Paper No. 8005, 51–8.—Low-pressure squeeze-cementing employs a small amount of cement squeezed into the perforations without fracturing due to high pressure. Filtration is important for success. Mathematical analysis of the procedure pointed to the important factors, and lab tests were confirmatory. The properties of the cement slurry, perforation geometry, and filtration time are important; these factors have been correlated. The permeability of the filter cake, visc of the filtrate, and the deposition constant (related to the vol of filter cake deposited) are involved, and can be grouped with the pressure differential applied to give the so-called composition factor of the slurry, a quantity which can be evaluated by filter cake tests using a pressure differential of over 800 p.s.i. for a known time. Casing must be properly centred in primary cementing, because the combined thickness of casing and primary cement is important in the geometrical factor. Filtration times for given amounts of deposition, with restriction of node formation, can be predicted. G. D. H.

2303. Method of predicting pressure maintenance performance for reservoirs producing volatile crude oil. R. H. Jacoby and V. . Berry. *J. Petrol. Tech.*, 1958, **10** (3), AIMME Tech. Paper No. 8006, 59–64.—Injection of dry gas into a reservoir containing a volatile crude can cause considerable vaporization of liq, the resultant wet gas on production adding to overall oil recovery. The more volatile the oil, the greater the addition. Conventional frontal-drive methods do not consider the contribution due to vaporization. The calculations developed in conjunction with experimental studies allow for vaporization during gas injection, and the results of recovery performance calculations are given for a reservoir with a highly volatile oil. The stock-tank oil recovery is *ca* twice that predicted by frontal drive.

Instead of gas/oil ratio rise at an increasing rate after breakthrough, the method gave a rapid rise to 12,000 cu. ft/brl, and then a less steep rise. The higher the reservoir pressure, the lower is the gas/oil ratio resulting from vaporization.

The calculations yield complete well-stream composition data which are valuable in designing gasoline plant facilities. G. D. H.

2304. Method for determining optimum second stage pressure in three stage separation. K. F. Whinery and J. M. Campbell. *J. Petrol. Tech.*, 1958, **10** (4), 53–4.—Two separators and a stock tank are involved, with gas sales conditions usually fixing the first stage pressure, and atm pressure applying at the third stage. Change in temp has little effect on the optimum pressure, so this factor was not considered.

For a given system curves show the optimum second stage pressure to be dependent on the first stage pressure. 17 different well streams, ranging from low gravity crude to condensate, were flashed through three stages to get comparable data, and the results were analysed empirically to obtain a simple and accurate correlation which did not call for flash vaporization calculations. Two equations were obtained. Their use calls for the specific gravity of the well stream, the first stage pressure and the percentage of CH_4, C_2H_6, and C_3H_8. The method is not a solution for all three-stage separation problems, and is not intended to replace the use of a digital computer for making flash calculations. The mean error in the results may be $\pm 5\%$. G. D. H.

2305. Application of the Buckley–Leverett frontal advance theory to petroleum recovery. S. G. Dardaganian. *J. Petrol. Tech.*, 1958, **10** (4), 49–52.—The application of the Buckley–Leverett frontal advance theory is described for the displacement of gas in the presence of an immobile water saturation, and to displacement of oil by water. In the latter case there may be free gas or immobile gas. Since an oil bank develops when there is mobile gas, the three mobile phases are considered as two separate systems in which only two mobile phases exist. Extension of these ideas permits a study of the effects of reservoir pressure in relation to the starting of a water flood, and for this purpose it is considered that low-pressure lab data can be employed, and not necessarily high-pressure data, which are costly to obtain. G. D. H.

2306. Effect of flow rate on paraffin accumulation in plastic, steel, and coated pipe. F. W. Jessen and J. N. Howell. *J. Petrol. Tech.*, 1958, **10** (4), AIMME Tech. Paper No. 8010, 80–4.—Tests were made on 5-ft lengths of $\frac{3}{4}$- and 2-inch dia steel, butyrate, rigid PVC, kralastic resin-type plastic pipes, epoxy coated pipe, PVC lined glass-fibre pipe, and aluminium pipe. The oil was heated prior to entry into the pipe manifold, the test pipes being in a cold water bath.

The rate of paraffin deposition reached a max at velocities just below the point where streamline changed to turbulent flow. Mass transfer accounts for the rise, but at the higher velocities drag tends to shear off deposits. Coated pipes showed the same general behaviour as steel pipe, but the amount of deposit was less. Cooling from the cloud point at the pipe wall leads to increased deposition as compared with oils below that temp before circulation. Thermal conductivity of the pipe is important in causing paraffin deposition. The hardness of the deposit depends on the temp. G. D. H.

2307. Miscible fluid displacement in porous media. J. W. Lacey, A. L. Draper, and G. G. Binder. *J. Petrol. Tech.*, 1958, **10** (4), AIMME Tech. Paper No. 8009, 76–9.—Refined

oils were displaced by propane from horizontal and vertical cores which were 9–36 ft long, using velocities comparable with field conditions. In horizontal flow mixed or transition zones formed early in the displacements, growing rapidly initially, and for 2-inch dia cores attaining 6–20 ft in length. The lengths of these quasi-stable zones seemed almost independent of the core material, but increased with rise in flow rate and with oil/solvent visc ratio. These results suggested essentially piston-like displacement of oil by solvent. The mixed zone length increased markedly with core dia, and variations in permeability may be important in this feature, leading to propane channelling.

Results obtained on small lab models cannot be extended directly to the field.

Short transition zones formed in vertical displacements dominated by gravity drainage, and miscible fluid displacement may give a very high recovery. G. D. H.

2308. Laboratory evaluation of prospective enriched gas-drive projects. D. M. Kehn, G. T. Pyndus, and M. H. Gaskell. *J. Petrol. Tech.*, 1958, **10** (6), 45–8.—For tests at reservoir pressures and temp clean sand was used in an 8-ft, 0·53-in dia tube. Salt water was displaced from the sand by oil. In one case simulated original reservoir oil was charged at 2000 p.s.i., and produced by solution gas drive to 300 p.s.i. before injecting gas. Two runs were made with a mixture of propane and low pressure separator gas containing 9·3% propane, the third with separator gas, and the fourth with a slug of enriched gas, driven by dry gas. The first two runs gave a high recovery for one pore vol of injected gas, the third was low, and the fourth gave the highest recovery.

In tests on high-gravity crude using field separator gas the recovery at one pore vol injection rose with increase in pressure above the bubble point. Propane was more effective than ethane as an enricher. It also seems that high recoveries are possible using enriched gas drive after water invasion. Large enriched gas slugs were more effective than small ones. High recoveries can be obtained by enriched gas drive whether the oil is originally saturated or under-saturated with gas at the displacement pressure. G. D. H.

2309. Effect of partial penetration on pressure build-up in oil wells. R. G. Nisle. *J. Petrol. Tech.*, 1958, **10** (5), AIMME Tech. Paper No. 8011, 85–90.—The theoretical investigation of pressure build-up in shut-in oil wells based on two-dimensional radial symmetry has been extended to the case of partially penetrating wells. Numerical solutions of the equations have been obtained and synthetic pressure build-up curves have been plotted for different degrees of penetration, including full penetration. At early times the slope of the pressure build-up curves approaches that for full penetration; at late times the slope is nearly proportional to the penetration.

Partial penetration produces a characteristic form for the build-up curve, and the form can be used to obtain the penetration ratio. Partial penetration does not invalidate the use of the classic theory for obtaining productivity from pressure build-up data. G. D. H.

2310. Hydraulic fracturing fracture flow capacity *v.* well productivity. H. K. van Poollen, J. M. Tinsley, and C. D. Saunders. *J. Petrol. Tech.*, 1958, **10** (5), AIMME Tech. Paper No. 8012, 91–5.—Lab studies of various kinds have been made to investigate the influence of various factors on well productivity following fracture treatment. Electrical models and other tests were used. It appears that for good productivity the largest practicable propping agent should be used, if not throughout, at least at the end of the operation. Fines released from the fractured surfaces, even in small amounts, impair the permeability if they are mixed with the propping agent. Too early production after treatment may remove the propping agent near the well, and such removal may allow fracture healing and reduction of effective permeability. Some treatment fluids may affect the strength of the rocks penetrated and possibly release fines which can be harmful. G. D. H.

2311. Some thermal characteristics of porous rocks. W. H. Somerton. *J. Petrol. Tech.*, 1958, **10** (5), 61–4.—Limestone, sand, sandstone, siltstone, and shale samples were examined for their thermal properties. The heat capacities increase with rise in temp up to 1000° F (the max temp used) and agreed well with the values calculated from the composition of the rock. Calculations for fluid-saturated rock indicated that gas or vapour caused little change, but liq water might raise the heat capacity by over 35%, depending on temp, pressure, and porosity; crude oil might give a rise of 17%. Liq saturation was found to increase heat conductivity markedly, but the influence of high pressure and temp was not studied. Earlier work indicated these factors to have large effects. Calculations showed the thermal diffusivity to be very sensitive to temp changes. G. D. H.

2312. Evaluation of porosity derivation from neutron logs. R. H. Widmyer and G. M. Wood. *J. Petrol. Tech.*, 1958, **10** (5), 57–60.—Test holes containing shaped rock slabs of known properties and with different simulated borehole sizes were constructed to evaluate various factors involved in the use of neutron logging for deriving porosity. High, medium, and low porosities, limestone, and sandstone were used, with fresh water in three holes and salt water in the other. Several different logging systems were employed, and runs were made with the sonde central, and at the wall of the hole. The effects of borehole size, sonde position, salinity, composition of the rock, and statistical variation were studied, and the average max error possible for each was derived. Borehole dia and sonde position seem to have the greatest effects on the reliability of neutron-derived porosities. Limestone and clean sands act similarly. G. D. H.

2313. Bubble point pressure correlation. J. A. Lasater. *J. Petrol. Tech.*, 1958, **10** (5), 65–7.—It was observed that for systems not near the critical point the bubble point was a direct function of the absolute temp. The solubility of the various hydrocarbons in the gaseous phase increases with mol. wt., *i.e.* saturation pressure should be inversely related to gas gravity. 158 experimentally measured bubble-point pressures on 137 independent crude oil systems were used to check the values indicated by the correlation based on these principles. The max deviation was 14·7%; 80% of the points had deviations less than 6·5%, while 21% had deviations under 0·5%. The field measured parameters ranged as follows: bubble point 48–5780 p.s.i.a.; flash G.O.R. 3–2905 cu. ft/brl; tank oil gravities 17·9°–51·1° API; gas gravities 0·574–1·223; reservoir temp 82°–272° F.

The data are based on systems from Canada, S. America, W. and Mid-Continental U.S.A.

The presence of large amounts of non-hydrocarbon gas causes the predicted bubble point to be low.

A chart based on the correlation is given. G. D. H.

2314. Use of hydraulic fracturing equipment for formation sand control. H. E. Rawlings. *J. Petrol. Tech.*, 1958, **10** (5), 29–32.—As an alternative to, and with probable improved performance as compared with, conventional gravel packing, the emplacement of sand has been carried out by modified hydraulic fracturing technique. This has been done in gun-perforated casing and with slotted liner, or with a combination of the two. During 2½ years 150 wells have been treated by this means in California, and formation sand control was obtained in 92% of the cases. Production improvement was

as much as 500% and averaged *ca* 250%. A considerable part of the improved production came from the ability to keep the wells on production longer, with no down time for remedial clean-outs.

The cost of pressure packing is generally higher than for conventional gravel packing and other sand control techniques, the difference depending extensively on local conditions. G. D. H.

2315. Effective compressibility of reservoir rock and its effects on permeability. A. S. McLatchie, R. A. Hemstock, and J. W. Young. *J. Petrol. Tech.*, 1958, **10** (6), 49–51.—The total pressure on any plane through a reservoir is the result of grain-to-grain rock pressure due to overburden and the pressure of interstitial fluid on the plane. As the latter falls net pressure on the rock phase rises, leading to compaction and decreased pore vol. This gives the effective compressibility. In the case of W. Canadian rocks a limestone with small vugs from 3200 ft had an average compressibility of $2{\cdot}2 \times 10^{-6}$ vol/pore vol/p.s.i., but a sandstone at 5300 ft showed $7{\cdot}7 \times 10^{-6}$ vol/pore vol/p.s.i.

Plastic-coated cores were also tested for oil permeability at high pressures. Preliminary data on shaly cores indicate that the lower the permeability at zero effective overburden pressure, the greater the percentage reduction in permeability at a given effective overburden pressure. The reduction was small for clean sands but large for shaly sands and greater with increased effective overburden pressure. G. D. H.

2316. Estimation of ultimate recovery from solution gas-drive reservoirs. W. L. Wahl, L. D. Mullins, and E. B. Elfrink. *J. Petrol. Tech.*, 1958, **10** (6), AIMME Tech. Paper No. 8018, 132–8.—A series of charts and correlations have been developed and are presented for estimating the recovery of oil from solution gas-drive reservoirs when only a minimum of reservoir data are available. The reservoir is assumed homogeneous, and to have neither gas cap, nor water drive, nor gravity drainage; there are no saturation gradients due to boreholes or other features, and the equilibrium gas saturation is 5%. P.V.T. data based on Mid-Continent, Gulf Coast, Canadian, and S. American systems were used in developing the charts employed. Differential liberation data are required in using the charts, which yield only the ultimate oil recovery from bubble point down to atm pressure.

Correlation charts link oil formation vol factor and bubble point pressure, solution gas/oil ratio and bubble point pressure, reciprocal gas formation vol factor and reservoir pressure, gas-saturated oil visc and solution gas/oil ratio, gas visc and reservoir pressure, flash and differential formation vol factors and solution gas/oil ratios, relative permeability ratios, total liq and interstitial water saturations.

Examples of the use of the charts are given. G. D. H.

2317. Material-balance method. Use of mass and energy conservation principle for investigating production and energy behaviour of petroleum deposits. (In German.) M. Stanciu. *Erdöl u. Kohle*, 1957, **10**, 574–80, 830–7. Pt 1. Deposit investigation problems; material balance; use of material-balance equations. Pt 2. Investigation of some German petroleum deposits.—Pt 1 contains the principle of the method. An equation is derived—based on the Schilthuis equation—for the special case of a gas-unsaturated deposit with partial water drive. The different forms of the equation correspond to the quantity sought, *e.g.* oil cont, water invasion, liq expansion or material deficit, saturation or oil–water-contact in the deposit. Use of the equations for determining recoverable material, also respecting production and energy development, is illustrated by a practical deposit example. 8 refs. Pt 2. Results of calculations in a series of deposit investigations, namely, the Rhaetic and Lias deposits, the petroleum oilfield Hohne, and the Dogger deposit of the field group Örrel-S/Wesendorf-N, are interpreted fully. From the val determined basic and gradual differences in type and magnitude of energy, also intensity of energy transfer in the treated deposits are recognized. Applications of the " material-balance " method are indicated thus for suitable opening of petroleum deposits and their rational exploitation. General characteristic curves are annexed presenting the results of deposit investigations. These curves, with knowledge of production and pressure development in a definite time period of the output history, permit qual evaluation of a deposit. R. T.

2318. Water analysis interpretation in secondary recovery projects. R. P. Kuykendall. *World Oil*, 1958, **146** (7), 209.—The standards for injection water in water flood operations and methods of treatment are described, the importance of proper treatment of injection fluids being emphasized. In evaluating a water analysis the most important characteristics to be noted are: (1) turbidity, which generally should not be greater than 1 p.p.m.; (2) oil content, which should essentially be zero; (3) total iron and manganese, which should be less than $\frac{1}{2}$ p.p.m. as they have bad plugging characteristics; and (4) dissolved gases, particularly H_2S and CO_2, because of corrosion risks. Turbidity can be controlled by filtration; oil content by filtration, skimming, or chemical treatment; iron and manganese by chemical treatment and filtration; and dissolved gases by aeration. C. A. F.

2319. High frequency explosive shock waves used in new fracturing process. Anon. *World Oil*, 1958, **146** (7), 189.—High frequency explosive shock waves have been successful as fracturing agents in *ca* 80% of wells treated for selective formation fracturing. The procedure consists of perforating the casing at the appropriate depth, fracturing, and then treating with acid wash. The high frequency explosive produces a series of pressure peaks which extend the fracture created by the initial explosion. In nitro-shooting only a single peak pressure is developed. A table gives the case histories of 12 treated wells. C. A. F.

2320. Tandem rod pump installations are successful. K. D. Van Horn. *World Oil*, 1958, **146** (6), 197.—An economic method of dually completing artificial lift deep wells has been a problem for some years, but recent installations of tandem rod pumps in eight deep wells in W. Texas have given good results. A new down-hole cross-over assembly has been used in wells completed with 5½-inch casing at a depth of *ca* 12,300 ft. The pumps have a common sucker rod string with two independent tubing strings. Details of the equipment are given, the pump depths ranging from 7900 to 10,100 ft. Pumps were of the insert type with parts retrievable on the rod strings. The positive displacement type was used as the upper pump, giving a double standing valve arrangement. Paraffin scrapers were used to prevent build-up of wax. C. A. F.

2321. Multiple completions save money offshore. J. H. Ray and K. G. Rowley. *World Oil*, 1958, **146** (7), 182.—Several different types of multiple completions have been introduced recently for wells offshore from Louisiana. They have resulted in reduced investment costs per well and cheaper workovers. The types of installation, described with diagrams, are: (1) single completions with one alternate zone; (2) two-string dual completions; (3) dual completions with an alternate to the lower zone; (4) dual completions with an alternate to either zone; (5) dual completions with three alternate zones; (6) triple completions with one alternate zone; and (7) triple completions with two alternate zones. All these are completions made through casing perforations, and a tubing string is provided for each producing zone. For

legal reasons the annulus cannot be used as a conduit in this offshore area. C. A. F.

2322. Retrospective look at a profitable water flood. S. F. DeVore and F. F. Wright. *J. Petrol. Tech.*, 1958, **10** (4), 21–4.—The Riverland and Scudder leases of the Alluwe pool, Nowata County, produce from the Bartlesville sand at depths of *ca* 400 ft. After primary production from 1906, vacuum was applied in 1914, the former going to gas injection in 1919; water flood began in 1948, using river water suitably treated to remove algæ and sediment. A five-spot pattern was used with shot wells. At first intermittent flow was used, and later continuous flow from the producers. Primary flow and gas injection gave 6493 brl/acre on the Riverland lease, water flooding having now raised the recovery to 9962 brl/acre; the corresponding figures for the Scudder lease are 9248 and 12,773 brl/acre. A well drilled on the latter lease in 1957 showed 17·93% oil in the lower sand and 44·77% oil in the upper sand. G. D. H.

2323. Variations in the physical characteristics of crudes in reservoirs. (In French.) H. Marion and P. Saubestre. *Rev. Inst. franç. Pétrole*, 1958, **13** (5), 767–79.—In tall oil columns it is necessary to consider the equilibrium conditions in the fluids arising from changes in temp and pressure. In the Tensleep reservoir at Elk basin the oil formation vol factor, the dissolved gas content, and the bubble-point pressure diminish with depth. For the Weber sandstone at Rangely the saturation pressure, dissolved gas/oil ratio, and the formation vol factor also diminish with depth, although the form of the curves differs from Elk basin. The Scurry Reef reservoir has a saturation pressure which falls with depth.

These variations raise problems in the use of the material balance relationship. It may be necessary to treat the reservoir as a series of layers, each with oil of given properties.

A field with bubble point increasing with depth has been reported; possibly the geothermal gradient is responsible.

Sage and Lacy's theoretical studies lead to the conclusion that under isothermal conditions the top of the column will be rich in light hydrocarbons. G. D. H.

2324. Performance of the Pickton field. H. B. Barton and F. R. Dykes. *J. Petrol. Tech.*, 1958, **10** (2), 27–31.—The Pickton anticline has dips of ½°–1½°, and produces from the Bacon (Lower Cretaceous) oolitic limestone at *ca* 7900 ft over some 7337 acres through 166 wells. The 50° oil had 1900 cu. ft. gas/brl at 3500 p.s.i. Gas injection began in 1949. Tests indicated that single-stage separation at 130 p.s.i.g. would give 0·48 brl/reservoir brl compared with 0·41 brl/reservoir brl at atm pressure, the respective oil gravities being 52° and 46°. Dissolved gas drive was dominant. Original stock-tank oil in place was 34,067,000 brl, and the estimated primary recovery was 19·4%. An injection rate of 15×10^6 cu. ft/day was considered most attractive economically, thereby giving a predicted recovery of 36%. 95% of the area was pooled initially. Because of pressure decline injection capacity was raised from 15 to 45×10^6 cu. ft/day. By April 1957 the recovery was 35% for injection of 80×10^9 cu. ft. of gas.

Studies suggest that water-flooding will be unattractive, and the same is true for enriched-gas drive. When the output falls to 1000 b.d. pressure maintenance is likely to stop. G. D. H.

2325. Comparison between the predicted and actual production history of a condensate reservoir. J. K. Rogers, N. H. Harrison, and S. Regier. *J. Petrol. Tech.*, 1958, **10** (6), AIMME Tech. Paper No. 8017, 127–31.—A small gas-condensate accumulation in the Paradox limestone at 5762–5806 ft in San Juan County, Utah, had a pressure drop from 2300 to 1782 p.s.i.g. in the course of producing *ca* 30 M.M.c.f. of gas. Thereafter reservoir and production data were collected according to a set programme. The pore vol was 658,000 cu. ft. according to material balance. A lab reservoir study was made using the initial well fluid samples, and the conditions were adjusted to be generally parallel with those of the accumulation. By means of conventional flash vaporization procedures and equilibrium constants the cumulative recoveries and well fluid compositions were calculated as a function of reservoir pressure. The field and lab data agreed closely, except that the gas/oil ratios deviated at the higher pressures. Greater composition accuracy would be obtained by the use of better equilibrium constants for the heavier hydrocarbons. G. D. H.

2326. Well completion practices in the Illinois basin. R. R. Vincent. *World Oil*, 1958, **146** (7), 214.—Most of the shallow wells in Illinois have been drilled with cable tools, the wells being carried to *ca* 10–20 ft above the expected pay and then cased. Drilling is resumed until the top of the pay is reached, and the entire pay is then cored, the shooting and final casing procedure being based on core data. Wells are shot with a mechanical time bomb, and they are usually completed with 1-inch or 1¼-inch pipe, a 2-inch perforated stringer being placed on bottom. Details for intermediate zone (1000–2500 ft) and deep zone (2500–4500 ft) completions are given. Injection strings vary in size up to 4 inches dia. C. A. F.

2327. Review of production performance of three deep Miocene oil pools in the Los Angeles basin. C. L. Doyle. *J. Petrol. Tech.*, 1958, **10** (3), 23–9.—The production performance of three small, deep Miocene pools is described: City zone of Inglewood City pool, Potrero field; Wardlow pool of Long Beach field; Santa Fe zone of Santa Fe Springs pool. Each pool has produced at near capacity rates since discovery. The City zone and Santa Fe zone had initial gas caps, and have given oil and condensate. Peak gas/oil ratios were reached at gas recoveries of 46–58% and oil recoveries of 6–10·5% of that in place. In the later phases of production plots of log oil rate against oil recovery are linear, the trends suggesting recoveries of 13·5–23% of the oil in place. At Wardlow deviation from this trend developed at *ca* 16% recovery, indicating that gravity segregation had become the main recovery mechanism, and there has been little decline since. Current gas recoveries are 65–89%. The substantial gas recovery following max gas/oil ratio is largely due to permeability and mobility ratio variations in the thick producing sections. G. D. H.

2328. Pembina pilot water flood proving successful. J. J. Justen and P. J. Hoenmans. *J. Petrol. Tech.*, 1958, **10** (6), 21–3.—Pembina has 2000 wells on 300,000 acres, and has given nearly 100×10^6 brl in five years. Currently it produces 100,000 b.d. Most wells are fractured in this Cardium stratigraphic trap for which neither free gas nor bottom water has been found. The undersaturated crude had 500 cu. ft. gas/brl and a bubble point of 1700 p.s.i.g. Natural depletion recovery has been estimated at 12·5%. A pilot flood began in Dec. 1956 on two adjacent 160-acre five-spots. Six injection wells, four observation wells, and producers were involved. Injection well-head pressures built to *ca* 700 p.s.i.g. and stabilized after less than 50,000 brl of water injection. Injectivity fell over time, probably due to bacteria and iron oxide slime. Bactericide, detergent, and acid have been used to combat this. In less than three months the gas/oil ratios of producers began to fall, reaching 400 cu. ft/brl in six months at 45,000 brl of water injection. The best response was on wells offset by two injectors. The observation wells offsetting the pilot area have shown an arrest of pressure decline.

At the beginning of 1958 water-flooding was extended to a 6400-acre block using water from the N. Saskatchewan river. G. D. H.

2329. Performance of the Leduc "D-3" reservoir. R. Horsfield. *J. Petrol. Tech.*, 1958, **10** (2), 21–6.—The Leduc "D-3" pool has an oil column of *ca* 40 ft over 21,640 acres at a depth of 5300 ft. Oil in place under a large gas cap originally exceeded 400×10^6 brl; beneath is 900 ft of water-bearing reef. Early on a wild well blew oil and gas for six months. Recovery is almost wholly by gas cap and water drive. Porosities may average 15%; horizontal permeability may exceed 1000 mD. Pressure behaviour and analogue studies pointed to interference by neighbouring pools via a common aquifer. To combat accelerated pressure decline and associated shrinkage losses co-operative water injection was begun in 1955 from the N. Saskatchewan river, the one injection well being able to take 65,000 b.d. After producing *ca* 100×10^6 brl of oil there has been only a slight rise in gas/oil ratio, and only one of the 535 producers has had to be abandoned, although seven wells near the injection well have begun producing water. Pressure is being maintained uniformly throughout the pool. In spite of the thin oil zone, the wells can maintain 100 b.d. without significant gas or water coning. This may be due to the high ratio of horizontal to vertical permeability. G. D. H.

2330. Miscible displacements of reservoir oil using flue gas. H. A. Koch and C. A. Hutchinson. *J. Petrol. Tech.*, 1958, **10** (1), AIMME Tech. Paper No. 4704, 7–10.—In the miscible slug process a band of LPG is injected into the reservoir prior to gas injection. Alternatively, gas may be injected, and this develops a zone of miscibility through mass transfer with reservoir oil. This is the case considered, and involves evaporation of intermediates from the oil into the gas phase. If this can be done below 4500 p.s.i. it may be preferable to the slug method.

Experiments have been made on long unconsolidated cores, using either nitrogen or lean gas or mixtures. The miscibility pressure was 3870 p.s.i. for N_2, and 3500 p.s.i. for lean gas. It also seems to require a longer sand column to develop miscibility with N_2 than with lean gas. Other experiments examined the effects of methane present in the oil.

Flue gas is less compressible than hydrocarbon gas, offering volumetric advantages, although there may be solution of CO_2. Inert gas could also be used for fill-up or to follow the lean gas with a miscible slug. G. D. H.

2331. Miscible drive—its theory and application. N. J. Clark *et al. J. Petrol. Tech.*, 1958, **10** (6), 11–20.—The miscible-drive technique shows great promise with regard to improving oil recovery. It has several forms, involving injection of propane, LPG, or gas into a reservoir under such conditions that fluid capillary forces are reduced to zero with essentially complete displacement of oil from those pore spaces penetrated by the injected material. Miscible drive does not penetrate all low-permeability and dead-end channels as water displacement may do. Thus water displacement in water-wet rocks during high oil saturation can give displacing coverage to a greater part of the total rock pore vol.

The aim is also to recover valuable injected materials, and at abandonment to leave the max of pore space occupied by dry gas. The factors which must be considered in planning miscible drive include the following: reservoir size and shape; distribution of porosity and permeability; nature of the crude; reservoir pressure and temp; injected gas composition and conditions for miscibility; fluid distribution. Lab studies must be made. Consideration must be given to the cost and availability of materials for injection, and not only to the total oil recovery expected, but when the oil will be obtained. G. D. H.

2332. Miscible drive field applications: Block 31 field. L. R. Kern, O. K. Kimbler, and R. Wilson. *J. Petrol. Tech.*, 1958, **10** (5), 16–20.—The 7000-acre Devonian University Block 31 field has been under pressure maintenance by gas injection for 8 years. The depth is 7900 ft, and reservoir thickness 1000 ft, and for miscibility between injected gas and the reservoir fluid 3500 p.s.i. must be maintained at the displacing gas front. 15 of the 73 wells are used for injection. The pressure fell to 3100 p.s.i. before injection checked it. At present output is 15,350 b.d. and injection 40 M.M.c.f. of gas/day. Except in boundary areas the producing G.O.R. has kept at the solution value of 1300–1500 cu. ft/brl. Pressure surveys have been made, and rates of injection adjusted to provide uniform sweep before major gas break-through occurs. The various studies pointed to leaks, and gaseous and water-soluble radioactive tracers were used to locate these, the latter being considered most effective. Leaks were found and repaired. G. D. H.

2333. Miscible drive field applications: Seeligson field. H. T. Wright. *J. Petrol. Tech.*, 1958, **10** (5), 13–16.—Zone 20-B of the Frio is 6000 ft deep, 14 ft average thickness, and produces over 585 acres via 11 wells. In producing 700,000 brl of oil (9% of original oil) pressure fell from 3010 to 2400 p.s.i., there being only a small gas cap.

Experiments on sand-filled tubes at 2000 p.s.i., using mixtures of propane and lean separator gas, led to the decision to inject 50% propane and 50% lean gas into Zone 20-B. A two-dimensional analysis of flood-out patterns was made with a high-speed computer. Estimates were made for two injection wells to get max pattern efficiency. Gas with 52% propane caused much more swelling of the Seeligson crude than did lean gas.

420 M.M.c.f. of gas and 290,000 brl of propane have been injected, but it is too early to evaluate the project. It is expected that when the enriched gas reaches the last row of producing wells, a substantial amount of the propane will be recovered by pressure depletion or dry gas cycling. G. D. H.

2334. Miscible drive field applications: Panhandle field. J. L. Ralph. *J. Petrol. Tech.*, 1958, **10** (5), 24.—The pilot project on the Hughey B. lease (Gray County, Texas) involves two injection and 12 producing wells in the Brown Dolomite reservoir. Between July 1957 and April 1958 some 126,488 brl of butane and 103,507 brl of propane, followed by 100 M.c.f/day of gas had been injected. Two offsets had raised static fluid levels and increased daily rates, and increased oil production to April 1958 was estimated at 8930 brl. G. D. H.

2335. Miscible drive field applications: Parks field. D. G. Marrs. *J. Petrol. Tech.*, 1958, **10** (5), 20.—Solution gas drive followed by pressure maintenance using water had given 3,500,000 brl of oil from the finely crystalline Bend limestone, where leaching of micro-fossils has given the main porosity. However, miscible displacement seemed promising, and lab tests were made, as well as potentiometric studies to decide on the best injection pattern. From June 1957 to Jan. 1958, 1,020,000 brl of propane was injected through 24 wells. Propane has not appeared in the 17 producing wells. A further 500,000 brl of propane are to be injected, followed by 8–10 M.M.c.f. of gas/day. Increased oil production is not expected before the end of 1958. G. D. H.

2336. Miscible drive field applications: Bisti pool. R. E. Brooks. *J. Petrol. Tech.*, 1958, **10** (5), 22.—The pilot test is a 40-acre 5-spot in the upper zone of the Lower Gallup sand, San Juan County, New Mexico. The reservoir is thin and tight. The operation is above 1207 p.s.i.a., the bubble point of the crude. 31,015 brl of butane and propane (7% of the hydrocarbon pore vol in the test area) was injected starting Aug. 1957. Subsequent gas injection was 500 M.c.f/day.

Three of the four producers have had high producing rates. Gas has broken through. Results are encouraging, and are approximately as predicted. G. D. H.

2337. Miscible drive field applications: Seminole City pool. R. E. Walker, J. D. Engel, and L. H. Jenks. *J. Petrol. Tech.*, 1958, **10** (5), 21.—The C-2 block leases produce from the Booch sand at 3600 ft. After 20 years of production the oil rate was 15 b.d. with a G.O.R. of 7500. The reservoir was repressured with gas; 143,000 brl of propane were injected through two wells, followed by gas. Five producers have since given 142,000 brl of oil, 12,000 brl being assigned to the injection of a water barrier.

Propane broke through almost at the start of the test, and 73,000 brl of propane have been produced. Probably only half the propane went into the test pattern. Water flood on a confined pattern might have given 100,000 brl of oil. G. D. H.

OILFIELD DEVELOPMENT

2338. Bolivia's oil outlook good as development is invited. J. E. Rassmuss. *World Oil*, 1958, **146** (7), 223.—New legislation in Bolivia has encouraged foreign capital, and extensive concessions have been applied for and are being granted. The country has a promising future for oil, but there are political problems because of opposition to the government oil policy. Oil development requires heavy foreign capital investment, and new pipelines are necessary. A pipeline to the Pacific at Arica has been approved and capital is assured. C. A. F.

TRANSPORT AND STORAGE

2339. Microballoons—five years later. Anon. *Oil Gas J.*, 18.8.58, **56** (33), 224.—Standard Oil Co. (Ohio) have reviewed the effect of use of microballoons in 30 cone-roof tanks over the last five years. Foam coverings in five out of every six tanks were in excellent condition; five of the 30 tanks had lost some or all of their coating due to operational conditions. G. A. C.

2340. Cone-roof tankage. E. W. Wilson. *Oil Gas J.*, 18.8.58, **56** (33), 222.—A vapour recovery system on cone-roof tankage in 8–13 R.v.p. gasoline service has been installed on three 55,000-brl cone-roof tanks at the Okmulgee, Oklahoma, refinery of Phillips Petroleum Co. G. A. C.

2341. Considerations on tankers. J. Perrachon. *Mot. Ship*, 1958, **39** (458), 174.—Single *v.* twin screw machinery is considered. The use of fuel oil in diesel engines is discussed.

The means of driving auxiliaries on a motor tanker are reviewed and, among others, the use simultaneously of exhaust gas boilers and electric generators driven from the shafting.

The problem of the use of a.c. machinery is discussed. D. K.

2342. The largest diesel-engined tanker. Anon. *Mot. Ship*, 1958, **39** (458), 153.—The largest diesel tanker launched recently is the 40,000-ton *Sven Salén*. Brief description only is given of the vessel. It has two Götaverken eight-cyl turbocharged two-stroke engines each developing 10,000 b.h.p. at 115 rev/min. D. K.

2343. Diesel engines instead of turbines in two 32,000-ton tankers for British owners. Anon. *Mot. Ship*, 1958, **39** (458), 150.—London and Overseas Freighters Ltd have switched two tankers, which were on order, from steam turbine machinery to diesel. Each vessel will be propelled by a single turbocharged De Schelde-Sulzer 9RD90 engine capable of developing 16,515 b.h.p. D. K.

2344. The M.T. *Petworth*, a 1200-ton 10½-knot tanker. Anon. *Mot. Ship*, 1958, **39** (456), 86.—The propelling machinery is a 1120-b.h.p. British Polar Engine rated at 250 rev/min. D. K.

2345. The Shell motor tanker *Abida*. Anon. *Mot. Ship*, 1958, **39** (455), 12; **39** (456), 60.—This vessel is the first of a series of 18,000-ton 14½-knot ships. A new form of streamlined superstructure is employed. The propelling engine is a Burmeister Wain turbocharged diesel, with seven cyl 740 mm in dia and with a piston stroke of 1600 mm and an output of 8750 b.h.p. at 115 rev/min. It will operate on boiler oil. The aux machinery is a.c. Engine room arrangements are discussed. D. K.

2346. Series of 19,250-ton tankers. Anon. *Mot. Ship*, 1958, **39** (457), 116.—*Ternöy*, the second of a series of 10 vessels, has 10,000-b.h.p. single screw machinery which gives a speed of 16 knots. The *Ternöy* has all accommodation aft with no midships structure. D. K.

2347. Standard 25,800-ton 16¼-knot tankers. Anon. *Mot. Ship*, 1958, **39** (456), 78.—The *Teheran* is the first of 14 ships of this class. It has a nine-cyl Eriksberg B and W turbocharged engine developing 11,200 b.h.p. at 115 rev/min. D. K.

2348. Performance of a diesel supertanker. Anon. *Mot. Ship*, 1958, **39** (457), 102.—This vessel, the 26,350-ton dw *Esso Aarhus*, is propelled by a 10,600-b.h.p. turbocharged B and W engine. It has a daily fuel consumption of 40¼ tons at an average speed of 15·9 knots. Operating costs are discussed. Available data on the performance of the vessel are tabulated. D. K.

2349. A 32,725-ton motor tanker. Anon. *Mot. Ship*, 1957, **38** (448), 244.—The maiden voyage of the Norwegian built M.T. *Fern Rose*, 12,500 b.h.p., is described. The average speed was 15·17 knots with the engine developing an average output of 10,110 b.h.p. at 103 rev/min. At this power total fuel consumption was 32 tons/day. D. K.

2350. The recovery of oil from sludge in oil tankers. J. Lamb. *Mot. Ship*, 1958, **39** (456), 74.—The *Vexilla* is equipped with machinery intended to separate the sludge left after tank washing into its components, oil, water, and sediment, by settling and dist. The equipment is described and details are given of tests carried out and results obtained. D. K.

2351. The nuclear merchant ship. A. P. Chalkley. *Mot. Ship*, 1957, **38** (447), 190.—The possibilities of the supertanker with nuclear machinery are discussed. Also considered is the future development of the marine reactor. D. K.

2352. The 19,000-ton tanker *Spinanger*. Anon. *Mot. Ship*, 1958, **38** (453), 502.—The propelling machinery is a Doxford built two-stroke opposed piston oil engine. It has six cyl of 650 mm bore, a combined piston stroke of 2320 mm, the 100% service output being 8000 b.h.p. at 115 rev/min. It has a.c. auxiliaries and fire protection arrangements, to Norske Veritas "F" notation requirements. D. K.

2353. The *Butmah*. Anon. *Mot. Ship*, 1957, **38** (451), 407.—34,000-ton tanker propelled by a MAN turbocharged engine of 10 cyl dia 780 mm and a piston stroke of 1400 mm, the output at 115 rev/min being 11,250 b.h.p. D. K.

2354. 5500 b.h.p. gas turbine for the *Auris*. Anon. *Mot. Ship*, 1958, **39** (455), 6.—The new turbine was developed by BTH and built by them in conjunction with Cammell Laird. It is designed to burn any grade of residual fuel. The turbine is multi-stage with uncooled rotors and casings and the combustion chamber is refractory lined. The thermal efficiency is 26·3%. D. K.

2355. Single-screw tanker with 15,000 b.h.p. machinery. Anon. *Mot. Ship*, 1957, **38** (448), 278.—Trials of the 33,500-ton M.T. *Yuyo Maru No. 5* are reported. The vessel attained a speed when fully loaded of 16·99 knots with the engine developing 14,610 b.h.p. at 113·78 rev/min. D. K.

2356. Avoidance of oil pollution. Anon. *Mot. Ship*, 1958, **39** (456), 58.—The type of equipment available for separation of oil from water is reviewed. Types discussed are Victor, Comym, White, Coastguard, and Simplex-Turbulo. D. K.

2357. Nuclear propulsion of merchant ships. Anon. *Mot. Ship*, 1957, **38** (448), 273.—Summaries of 13 papers giving particulars of American activities. Design of a 12,000-ton ship to be laid down in the near future; the advantages of gas turbine propulsion and a closed cycle boiling water reactor for a 38,000-ton tanker are subjects particularly considered. D. K.

2358. Telemetering for automatic pipelines. F. V. Long. *Pipe Line News*, June 1958, **30** (6), 38–44.—As long as no automatic control of pipelines was attempted, slow feedback of information about operating conditions along pipelines by telemetering or telephone was sufficient. With the increase in size, throughput, and cost of pipelines, the need for operation at max throughput has become essential. Gas lines require more attention than oil lines, and the type of control required for gas lines is considered. The two principal control techniques are those of sectionalized and centralized control systems. In the former information from each of several satellite stations is sent to a control station, of which there are several. Information is passed back from these control stations to the central despatch point to enable an overall picture to be obtained. In the latter, all satellite stations are connected to one central control station; this calls for much greater communications reliability, but allows for a reduction in staff. This type will be used when full automation is introduced, using a computer to correlate data from sales and gathering points as well as from along the line. The present situation in line control is discussed. D. K. R.

2359. Marine construction trends: combined corrosion protection and weight applied over the ditch. W. Quarles. *Pipe Line News*, June 1958, **30** (6), 45–6.—When laying some 45 miles of gathering system in coastal marshes and open Gulf water near New Orleans for Southern Natural Gas Co., Houston Contracting Co. used a combined anti-corrosion and weight coating. This homogeneous coating, which is an emulsified asphalt mixture containing liq latex, glass fibre, and an aggregate, is extruded on to the pipe just before laying. Iron barites mixed with drilling mud or a sand and gravel mix is used for weighting material, depending on the negative buoyancy required. Description of the method of application is given and fringe benefits of the process mentioned. D. K. R.

2360. Design suggestions for multiphase flow in pipelines. O. Baker. *Pipe Line News*, June 1958, **30** (6), 23–30.—The need for knowledge about the behaviour of two-phase flow in pipelines has been emphasized by the importance of pressure drop in the development of large gas transmission lines and the desirability of bringing both gas and oil from offshore drillings in the same pipeline. Pressure drops of up to 10 times that for single phase flow are often found in two-phase pipelines, and this is largely due to separation of the components because of the differing drag on them. At equilibrium the liq may fill as much as 80% of the vol of the pipe. Loss is also caused at the interface between the two phases when the gas velocity becomes sufficient to cause waves which may fill the pipe in places. Equations for these pressure drops are given. The various types of flow existing in a pipeline as the quantity of gas is increased are discussed, and equations developed for two-phase flow pipeline efficiency. Design data are given for the different regions. Some correlations for two-phase pressure drop are compared with an operating pipeline, and this shows deviations varying from −26 to −86%. D. K. R.

2361. Flow phenomena in large diameter gas pipelines. W. R. Staats and R. T. Ellington. *Pipe Line News*, Aug. 1958, **30** (8), 23–7.—Description is given of work done to obtain flow information on pipelines from 12- to 36-inch dia. The general flow equation is given in terms of "transmission factor," defined as the inverse square root of the friction factor. Flow rates are proportional to the transmission factor, both where the flow is non-turbulent and where there is fully-turbulent flow. Equations for both cases are given and analysed in the light of experimental results. The following conclusions with regard to natural gas transmission design are reached: (1) for the fully turbulent region (most operating conditions), flow equations should be based on a transmission factor independent of Re, and depending on surface roughess and pipe dia; (2) for smooth pipe behaviour flow equations based on Re and not surface roughness or pipe dia should be used; (3) for the transitional range sufficient accuracy is obtained by extrapolating the fully turbulent region line until it cuts the smooth pipe behaviour curve. D. K. R.

2362. Experiments on the Beynes subsurface gas storage reservoir. (In French.) L. Richard. *Rev. Inst. franç. Pétrole*, 1958, **13** (2), 131–42.—The Beynes anticline, 5·5 km long and 2·5 km wide, has 23 m closure and lies 40 km W. of Paris. The Wealden reservoir underlies 7 m of plastic clay. The loose sand of 32–35% porosity has a permeability of 3·5–17 darcys. Since small faults or other gaps in the cover would be difficult to detect, filling with gas was the only real test of tightness. The use of air for this purpose involved risks. Purified coke gas had to be piped 29 km and compressed to 45 atm for injection through five wells. Four wells were needed to observe the fall in water level. Injection continued from 20 Nov. 1956 to 3 April 1957, totalling 28×10^6 cu. m. of gas. Pressure stabilization continued until 2 May 1957.

Gas withdrawal took place from 14 May to 29 June 1957, and it was calculated that of $9{\cdot}2 \times 10^6$ cu. m. produced 24·5% was by decompression and the rest by water advance, indicating active water drive. Further calculations showed that 15 wells would be needed for a withdrawal rate of 200,000 m³/hr. Vaporized water separates from the gas produced, and the well and other equipment had to be protected from corrosion. Sand movement was prevented by special subsurface equipment.

Various components in the gas went into solution or reacted in the reservoir. An appreciable temp rise was noted. G. D. H.

2363. Technical factors governing the economics of gas storage in aquifers. (In French.) R. Fort. *Rev. Inst. franç. Pétrole*, 1958, **13** (2), 119–30.—The site of the reservoir considered for gas storage must be satisfactory in relation to the source of gas and the area to be supplied. Core-drilling or seismic work may be needed to get the form of the reservoir, and tests of tightness are needed when it is not an abandoned oil or gas

field. Wells must be properly cemented. The deeper reservoirs may offer advantages. Porosity and permeability are important, as is the presence or absence of water-drive. Careful checks of input and output, or suitably placed wells in overlying porous zones may reveal leaks. Possible rates of output are important. The form and thickness of the reservoir zone affect not only the storage capacity, but also the permissible water rise and the size of the gas cushion.

Courageous decisions may have to be made in trying to evaluate a structure for gas storage purposes. G. D. H.

REFINERY OPERATIONS

REFINERIES AND AUXILIARY REFINERY PLANT

2364. Plant commissioning. Experience on a new oil refinery. D. W. K. Barker. *Fluid Handl.*, 1958, 229–32.—Summary of paper presented to the Joint Symposium on the Organization of Chemical Engineering Projects. Various aspects of the commissioning of a new oil refinery are discussed with special ref to Kwinana refinery. Points dealt with include planning, establishing a commissioning programme, staff recruitment and training, procedure with regard to plant alterations and start-up, and instrumentation. W. A. M.

SOLVENT EXTRACTION AND DEWAXING

2365. Reduced crude oil–dipropylene glycol liquid–liquid extraction system. F. F. Papa-blanco and M. van Winkle. *Industr. Engng Chem.*, 1958, **50** (4), 703–6.—In view of the possibility that some of the higher mol. wt. glycols might be economic solvents for processing residual oils, the system dipropylene glycol–reduced crude oil was studied at 160° and 212° F to determine phase equilibrium data. Phase diagrams and tables of equilibrium data for the system are given, and results indicate that the selectivity of dipropylene glycol for the low visc–gravity–temp components was very good, with relatively greater selectivity at 160° F than at 212° F. D. K. R.

HYDROGENATION

2366. Thermal hydrogenation: transfer of hydrogen from tetralin to cracked residue. C. S. Carlson *et al. Industr. Engng Chem.*, 1958, **50** (7), 1067–70.—Using tetralin as a reaction diluent, crude residue can be thermally cracked, the tetralin being dehydrogenated to naphthalene. This process, using a mixed naphthenic–aromatic condensed ring cpd such as tetralin, is selective, minimizing the formation of coke and dry gas. The hydrogen transfer occurs without cat being present. The theoretical considerations of the process are given, and tables of results showing the effectiveness of various diluents. D. K. R.

2367. Hydrogenating treatment of petroleum products. (In German.) P. W. Sherwood. *Erdöl u. Kohle*, 1957, **10**, 503–8.—In 1954 the capacity for treating petroleum products in the U.S.A. was 50,000 b.d., for 1960 installed capacity is estimated at 1·5 million b.s.d. Relevant factors for the increase are H_2 availability as a by-product, and quality competition in petroleum products. A third factor is the increasing quantity of poor quality crude which must be processed. Hydrogenation treatment processes work chiefly below 70 atm. An incomplete list of processes—similar in basic idea—but varying in planning, cat properties, and operation—is given. Cat used are generally Co or Mo cpds or mixtures of both on Al_2O_3, SiO_2–Al_2O_3, sometimes W salts are used. Benefits are O_2 and N cpd removal and a better yield of cycle stocks, reduced gum formation by diolefin saturation. Operating details of Autofining, Hydrofining, and Gulf-HDS processes are given. R. T.

2368. Lowering of activity of a hydrogenation catalyst by contaminants from tars. (In Czech.) O. Svajgl. *Chem. Prumysl.*, 1958, **8**, 13–17.—This is an analysis of the influence of contaminants from tars on the activity of recycled cat in liq phase hydrogenation of tars. Neither arsenic and vanadium nor asphaltic substances have a bad effect, provided that the latter are not further degraded into coke-like matter. The cat activity was lowered only by solid contaminants (semi-coke dust from carbonization). Thus by removing such contaminants from tars more olefins may be obtained in hydrogenation. G. W. T.

SPECIAL PROCESSES

2369. Shallow and deep dehydrogenation of petroleum C_8-aromatic fraction. B. B. Corson, W. J. Heintzelman, and F. J. Pavlik. *Industr. Engng Chem.*, 1958, **50** (4), 621–2.—Of the two valuable components of petroleum C_8-aromatic fraction, ethylbenzene and xylenes, only *o*-xylene is separable from the C_8-fraction by dist. Under certain conditions *o*-xylene free petroleum C_8-fraction can be dehydrogenated so that ethylbenzene is converted to styrene and the *m*- and *p*-xylenes survive to give a catalysate from which styrene can be recovered by dist. Details of the yields obtained by dehydrogenation of C_8-fraction over 1707 cat (72·4% magnesium oxide, 18·4% iron oxide, 4·6% potassium oxide, and 4·6% copper oxide) under various conditions are given, and the reliability of the data obtained is considered. D. K. R.

PRODUCTS

CHEMISTRY AND PHYSICS

2370. Calculating equilibria in ethane, propane, and butane decomposition. (In German.) H. Pietsch. *Erdöl u. Kohle*, 1957, **10**, 666–9.—Simultaneous equilibria are calc for decomp of CH_4, C_2H_6, and C_3H_8 disregarding C formation. The calculations—useful for a system containing several initial substances, *e.g.* in autothermic cracking or combustions—are carried out for the conventional range of cracking temp 900°–1300° K at pressures of 0·5–1·5 atm. C_4H_{10} decomp is taken as an example to explain the separate calculation stages. From the calc equilibrium concn of the cracked gases—important for valuing the cracking investigations and process—the reaction course is interpreted. 7 refs. R. T.

2371. New separation process based on O'Keefe's method using Craig's apparatus. (In Czech.) J. Mokry *et al. Chem. Zvesti*, 1958, **12**, 382–9.—This article describes a new fractional separation process based on O'Keefe's countercurrent extraction method carried out in an automatic glass Craig's

apparatus, as modified by Metzsch, with 200 separation elements. This new process is also a Craig separation with two-phase extraction. The mixture is introduced in the form of a soln. A conversion factor is given for the required increase in the number of separation elements in the left-hand portion of the apparatus. G. W. T.

2372. The minimum explosion temperature of saturated hydrocarbons with primary and secondary carbon atoms in the molecule. (In French.) M. Lucquin. *C.R. Acad. Sci., Paris*, 1958, **246**, 2747–50.—The minimum explosion temp of saturated hydrocarbons were determined under precisely defined conditions to see how these temp varied with R, where R is the ratio of the number of primary carbon atoms in the molecule to the number of primary and secondary carbon atoms. The hydrocarbons examined ranged from *cyclo*pentane and *cyclo*hexane, where $R = 0$, to neopentane, where $R = 1$. The results obtained were interesting, but it was concluded that R is not the only structural parameter involved. P. H. S.

2373. Plate efficiencies and yields in extractions using rotary columns. (In German.) V. Kalab *et al. Coll. Trav. Chim. Tchecosl.*, 1958, **23**, 352–9.—Using two different types of rotary extraction columns, the authors have studied the dependence of plate efficiency and yield on the speed of rotation. For the extraction of ε-caprolactam or *cyclo*hexanone oxime from an ammonium sulphate soln using *cyclo*hexanone countercurrent, it was established that for a constant throughput the efficiency and yield vary in direct proportion to the height of the packing material and the speed of rotation. The dependences in both columns were of a relatively similar character; the max yield depended on the value of the partition coeff, and the plate efficiency on the number of plates and the amount of solvent used. G. W. T.

2374. Changes in the properties of an asphalt during the blowing operation. L. R. Kleinschmidt and H. R. Snoke. *J. Res. Nat. Bur. Stand.*, 1958, **60**, 169–72.—Determinations were made of the physical characteristics and component distribution of an asphalt flux and of asphalt products at six 2-hr intervals during the conversion, by air blowing, of the flux to a coating grade asphalt. The soft. pt. and asphaltene content of the asphalt products increased linearly with time during the blowing operation. There was essentially no change in percentage, refractive index, and visc of the water-white oils during blowing. The percentage and refractive index of the dark oils decreased progressively during the blowing operation. G. W. T.

2375. Mass spectra of aromatic hydrocarbons filtered from smoky air. F. L. Mohler *et al. Bur. Stand. J., Wash.*, 1958, **60**, 615–18.—Particulate matter was collected from smoky air, and aliphatic and aromatic hydrocarbons separated from this material. Samples were analysed by two methods. First, the sample is slowly evaporated from a tube furnace directly into the mass spectrometer and spectra recorded as the temp is increased step by step. Secondly, the sample is completely vaporized in a heated reservoir and the vapour passed through a leak into the mass spectrometer. Mass spectra of the aliphatic cpds are not reported in detail. Mass spectra of the aromatic fractions evaporated from the tube furnace indicate sharply defined fractionation with molecule ions of fused-ring aromatics predominant. Cpds containing three to seven fused-rings are tentatively identified. The mass spectrum from the reservoir mass spectrometer was recorded at ionizing voltages of 70 V and at a low voltage, which gives predominantly molecule ions. The fused-ring aromatics include cpds that are carcinogenic. G. W. T.

ANALYSIS AND TESTING

2376. Spherical apparatus for measuring the thermal conductivity of liquids. V. E. Schrock and E. S. Starkman. *Rev. sci. Instrum.*, 1958, **29**, 625–9.—This apparatus was designed and constructed for application to relatively viscous liq such as hydrocarbon lubricants over a temp range from ambient to −100° F and encompassing the solidification temp. Freedom from the effects of convective heat was demonstrated experimentally. The absolute accuracy of the measurements made with this instrument is believed to be within 2%. G. W. T.

2377. Automatic determination of sulphur trioxide in flue gases. P. H. Crumley, H. Howe, and D. S. Wilson. *J. Inst. Fuel*, 1958, **31** (212), 378. The instrument described automatically determines the SO_3 and sulphuric acid vapour in flue gases in the range 10–100 p.p.m. by vol. It operates by absorbing the SO_3 in an *iso*propyl alcohol soln, and precipitating it as barium sulphate; the optical density of the suspension is measured photo-electrically. D. K.

2378. Polarographic estimation of benzene in commercial gasolines. (In Czech.) V. Sedivec. *Chem. Prumysl*, 1958, **8**, 180.—A polarographic method for the estimation of benzene in the presence of other aromatic hydrocarbons has been adapted for the analysis of gasolines. The validity of the method has been checked on specially prepared mixtures and on gasolines containing known amounts of aromatic cpds. G. W. T.

2379. Progress Review No. 43. Liquid fuels. (1) Sampling; (2) Testing methods and their interpretation. C. W. G. Martin. *J. Inst. Fuel*, **31** (209), 274.—The major part of the article deals with petroleum fuels, though there is a short section on coal tar fuels. A short general discussion on sampling is given. Specifications for domestic fuel oils, industrial, and marine fuels are considered. The analytical tests which go to make up these specifications are examined briefly. D. K.

2380. Progress Review No. 44. Sampling, analysis, and testing of gaseous fuels. G. R. Boreham. *J. Inst. Fuel*, 1958, **31** (210), 304.—New methods of analysis, sampling, and testing are outlined, but in many cases they are only modifications of existing techniques. 49 literature refs. D. K.

2381. Estimation of petrol vapour concentration by means of a red-hot platinum wire. (In Czech.) S. Fiala. *Chem. Prumysl.*, 1958, **8**, 240–2.—The influence of a glowing platinum wire on a mixture of petrol vapours in air and the concn at which this initiates an explosion have been studied by a specially constructed apparatus. The wire has no effect if the vapour concn exceeds 450 mg/litre. In the concn range 250–400 mg/litre the vapours are catalytically oxidized, while in the range 100–250 mg/litre at temp above 200° C, explosions are initiated. G. W. T.

2382. Determination of total sulphur in volatile liquids. (In Czech.) J. Romovacek *et al. Paliva*, 1958, **38**, 113.—A method is described whereby the sample is introduced into a capsule of polyamide or polyethylene foil and burnt in oxygen at a pressure of 30 atm in a bomb calorimeter. The sulphur dioxide formed is absorbed in a 3% aq soln of hydrogen peroxide, and the sulphate ions thus formed are determined by complexometric or conductometric titration. G. W. T.

2383. Gas–liquid chromatographic resolution of *m*- and *p*-xylene : tetrahalophthalate liquid phases. S. H. Langer, C. Zahn, and G. Pantazoplos. *Chem & Ind.*, 1958, 1145–7.—Relative retention vol at 110° C for toluene, *m*-, *p*-, and *o*-

xylenes, ethylbenzene and n-$C_{10}H_{22}$ are given for columns of methyl propyl tetrachlorophthalate, di-n-propyl tetrachlorophthalate, and di-n-propyl tetrabromophthalate. The first two of these can be used to separate m- and p-xylenes on columns of *ca* 6000–7000 theoretical plates. Effectiveness is due to electron donor–acceptor interactions. W. A. M.

2384. Simple method for chromatographic decomposition of lubricating oil fractions. (In German.) G. Schwarz. *Erdöl u. Kohle*, 1957, **10**, 588–92.—By the method described and illustrated with numerous diagrams, the saturated hydrocarbons can be separated perfectly from petroleum fractions in the lub oil range. A rapid method on the same principle can be introduced for series investigations. The method proved valuable in investigating the structure of lub oil fractions from the Vienna basin crude oil, in investigating structural changes on refining, in analysis of oils containing additives, and on distribution of S-cpds in the individual lubricant components. R. T.

2385. Infra-red spectroscopic analysis of alkylbenzenes. (In German.) K-D. Ledwoch. *Erdöl u. Kohle*, 1957, **10**, 595–6.—A simple relationship can be derived from intensity measurements of the i.r. 1605K-absorption band, between α' (Bunsen extinction coeff), and mol composition of mono-n-alkylbenzenes. The ε val (mol extinction coeff) of the homologous series are const, excepting for the first two members. Therefrom it is possible to analyse completely mixtures of alkylbenzenes and paraffin hydrocarbons by measuring α' and ε, also d and mol. wt. R. T.

GAS

2386. Lacq: its problems and potentialities. A. Blanchard. *J. Inst. Fuel*, 1958, **31** (212), 393.—The development of Lacq gasfield in SW. France and the difficulties which have been overcome are described. The gas contains 15% H_2S. Accessory plants are required to separate H_2S and CO_2, recover condensate products, and extract S from the H_2S. The problems arising from all these operations are described. It is estimated that 1,300,000 metric tons of S a year will be produced. Other raw materials available will be methane, ethane, propane, butane, and gasoline. D. K.

2387. Production of high-B.t.u. oil gas in a cyclic-regenerative pilot unit with hydrogen as carrier gas. J. M. Reid, W. G. Bair, and H. R. Linden. *J. Inst. Fuel*, 1958, **31** (210), 325.—Results of the production of high-B.t.u. oil gas by cyclic thermal cracking of petroleum oils are presented. The four shell cyclic-regenerative unit was of improved design and had an oil capacity of 50 gal. Complete operating data were obtained at gasification pressures up to 50 p.s.i.g. and at carrier gas rates of up to 65 s.c.f/gal of oil. Results indicate the use of process hydrogen permits production from all types of oil of gases of 1000 B.t.u/s.c.f. and 0·6 to 0·7 sp. gr. and combustion characteristics approaching natural gas. Diagrams of the plant and tabulated gasification results are included. 34 literature refs. D. K.

ENGINE FUELS

2388. Some studies of radiating flames in a small gas turbine type combustion chamber. D. J. Weeks and O. A. Saunders. *J. Inst. Fuel*, 1958, **31** (209), 247.—Total radiation and absorption and spectral radiation and absorption were measured on a small swirler type combustion chamber using, as fuel, kerosine, a blended fuel, and heavy "Mothball" fuel. The distribution of composition and temp across flame widths is very non-uniform near the burner, and therefore care is necessary in defining effective temp, emissivity, and absorptivity, and in interpreting results of measurements. 6 refs. An appendix gives details of the Schmidt method. D. K.

GAS OIL AND FUEL OIL

2389. Low voltage electricity heats fuel oil lines. J. L. Dupuis. *Fuel Oil & Oil Heat*, 1958, **17** (1), 72.—U.S. dealers' findings on the use of thermal electric systems to heat fuel oil lines are reported. D. K.

2390. Effectiveness of diesel fuel additives. (In German.) J. S. Meurer. *M.T.Z.*, 1957, **18**, 384–7.—A new test method was used which enabled reproducible results on the deposit-forming process to be obtained. This was achieved by raising the nozzle temp to 200° C. The investigations included tests of nozzle-flow rates, constant b.m.e.p. tests, and exhaust-gas observations. Several additives, including HD oil additives, were tested for their ability to dissolve carbon. Results indicated that diesel fuel additives can be effective in preventing nozzle coking, but that their influence in other parts of the combustion chamber is uncertain. G. W. T.

2391. Progress Review No. 41. Fuel utilization in the glass industry. M. Parkin. *J. Inst. Fuel*, 1958, **31** (206), 115.—The main aspects considered are: gas producers; oil heating; furnace design; assessment of furnace performance; heat recovery; aux plant; and instrumentation and control. Tables show consumption of fuel by the glass industry and glass container production over a period of 30 years. 21 literature refs. D. K.

LUBRICANTS

2392. Thin film lubrication. C. Siripongse *et al.* *Engineering*, 1958, **186**, 146–9.—In Pt 1 investigations have been made of the voltage/current characteristics of thin oil films. It was demonstrated that, for normal oils, the drop across the film is independent of the current above *ca* 0·5 amp, and that the valve is independent of visc and speed of the moving surfaces. Pt 2 reports a study of the electrical characteristics of a four-ball machine, using the data obtained in the previous part. The main features of frictional phenomena are explained using standard concepts. G. W. T.

2393. The development of radiation-resistant lubricants. R. Irving. *Shell Aviat. News*, 1958, **238**, 14–15.—The article describes studies in radiation effects on lubricants carried out at Thornton Research Centre. Hydrocarbon oils, synthetic fluids, and greases have been examined. The results indicate that a major factor determining the resistance of an oil to the effects of high-energy radiation may be connected with the presence of aromatic cpds. G. W. T.

2394. The use of polytetrafluoroethylene as a lubricant. E. Kay. *Brit. J. appl. Phys.*, 1958, **9**, 17–25.—The use of this chemical in bulk form as a bearing is limited by its low strength and poor thermal conductivity. Experiments are described in which these limitations are overcome by the deposition of thin films on metal surfaces. Frictional tests under a variety of conditions show that tenacious films of low frictional coeff and high load-carrying capacity can be prepared. These properties are considerably enhanced by using a surface phosphating treatment prior to application of P.F.T.E. G. W. T.

2395. Influence of the pressure of the external gas on the greasiness of lubricants. (In French.) G. Volovick. *C.R. Acad. Sci., Paris*, 1958, **246**, 764–5.—This paper gives results of experiments on variations in the greasiness of refrigerator

lubricants at pressures below 1 mm Hg. These results confirm that the surface concerned is covered with a mol layer of oil and adsorbed gas; that as the pressure decreases the amount of gas molecules becomes less; that the boundary film tends to become more and more composed of oil molecules; and thus the greasiness of the lubricant is increased. P. H. S.

2396. Predicting effects of temperature and shear rate on viscosity of viscosity index-improved lubricants. H. H. Horowitz. *Industr. Engng Chem.*, 1958, **50** (7), 1089–94.—The work presented makes possible the prediction of the visc of V.I.-improved mineral oils at various temp and at high shear rates. The usual methods do not hold for this class of lubricant. Reduced variable flow curves are given from which the visc–shear curves of most V.I.-improved oils can be obtained. The theory of the method used to obtain the graphs and equations presented is given. D. K. R.

2397. The influence of additives on the thickness of lubricant films. (In German.) A. Dierichs. *Schmiertechnik*, 1958, **5**, 63.—The thickness of lub oil films between two static, highly-polished smooth surfaces was first measured by Ubbelohde by means of an interference comparator. Experiments carried out on unmixed oils (*i.e.* those not containing additives) with loaded and carefully polished glass and metal plates made it seem probable that under the same load the thickness of the oil film increased as the behaviour of the oil under mixed friction improved. However, the experiment described here, using metal plates, showed that oils containing high pressure additives form thinner films than unmixed oils do. It is assumed that this surprising result is caused by chemical reaction between the additives and the metal surfaces. G. W. T.

2398. Viscosity classes and V.T.-behaviour of lubricating oils. (In German). G. H. Göttner. *Schmiertechnik*, 1958, **5**, 69.—For the classification of lub oils according to visc a reference temp of 50° C has been established in Germany. If the oils are to be used at temp above this figure, then they cannot be characterized by giving the visc class alone: the V.T. (viscosity–temp) behaviour of the oil must also be determined, even if for the particular application it is meaningless as a criterion of quality. The ordinary values for V.T. behaviour of lub oils are too precise for this purpose, and a lesser range, derived from the visc classification by standard values, is proposed. This also makes possible a simple classification of oils by V.T. classes. The method of characterization of visc classes and V.T. behaviour of oils is easy to understand, and is thus able to simplify the choice of oils for industrial purposes. G. W. T.

2399. The mechanical wear of metals. W. Hirst. *Brit. J. appl. Phys.*, 1958, **9**, 125–32.—The wear phenomena encountered in the conditions of speed and loading of industrial machines is considered. Apparatus is described in which nominal point or nominal line contact can be maintained indefinitely, and some of the characteristics observed when a lubricant is used are discussed. The main phenomena, the laws and mechanisms of wear in unlubricated conditions are discussed, and the present state of development of theories of wear is outlined. G. W. T.

2400. Investigation contribution to technical testing of gear oils. (In German.) W. Hampp. *Erdöl u. Kohle*, 1957, **10**, 519–23, 596–9.—Pt 1. Friction measurements with the Amsler machine. Pt 2. Wear measurements with the Amsler machine; friction and wear measurements with the four-ball apparatus.—Pt 1. Investigations on gear oils on the two machines under varying load, motion, and temp conditions are reported. Quality conception is not absolutely fixed, but shifts according to the use of the oil either more towards less friction, less wear, or prevention of seizing. These properties do not run always in the same direction. In the region of friction wear differences in friction coeff of various oils, relatively small, vary with oil composition. Friction coeff increases with surface roughness, with higher temp, decreasing abs sliding velocity, and increasing slip. Smallness of the friction differences makes the use of alloyed oils of doubtful benefit under normal loading conditions. However, with low wear, additions play a great part. Here machine oils with fat addition give much less wear than pure mineral oils. Gear oils with max pressure additions do not require expensive doped oils with moderate loading. With high pressure and temp requirements of HD-gears they are technically and economically correct, the special properties of the HD lubricant taking effect.

Pt 2. In the hydronamically unfavourable geometrical contact surfaces, corresponding in principle to those of cog wheels and roller bearings, an influence of oil visc could be detected, whereby a much greater portion dropped on the fluid friction with better surface quality. The Amsler machine is suitable chiefly for investigations in the region of friction wear; the VKA for determining limit loadings for the transition from friction to seizing wear, friction and wear behaviour in the seizing-wear region, and wear-loading estimation. R. T.

2401. Structural changes of sodium lubricating greases under the influence of oxygen. (In Czech.) V. Kabes *et al.* *Chem. Prumysl.*, 1957, **7**, 590–3.—The relation between the degree of grease oxidn and analytical data has been studied. An electron microscope was used to study the structure of the grease at various stages of oxidn. The changes in the properties of the oxidized grease are paralleled by structural variations. G. W. T.

2402. Diesel engine crankcase explosions. Anon. *Mot. Ship*, 1957, **38** (447), 227.—Graviner Manufacturing Co. have developed an apparatus designed to identify the presence of white or condensed oil mist. The apparatus employs photo-electric cells and operates on the principle of measuring the degree of mist density by obscuring the light falling on the cells which are normally in electric balance. The apparatus is mounted directly on the crankcase and draws continuously from it. D. K.

2403. Lubrication of large diesel cylinders. J. E. Cox and P. D. Hobson. *Mot. Ship*, 1958, **39** (457), 121.—The problems encountered, and measures taken to solve them, when heavy residual fuels are burned in large diesel engines are discussed. Results of field trials are reported using radioactive tracers to determine extent of combusion products contamination. A highly basic emulsion lubricant was developed, and field trials and subsequent commercial application have confirmed lab predictions of the advantages of this type of lubricant. D. K.

2404. Cylinder liner wear. Anon. *Mot. Ship*, 1958, **39**, 187.—Results are given of the use of Caltex Super DCL (formerly ETL 7A) cyl lubricant in large marine engines. This incorporates additives having enhanced E.P., detergent, and alkaline properties. Figures indicated wear reductions of up to 88% in engines burning residual oil, and up to 86% in engines operating on diesel oil. G. W. T.

BITUMEN, ASPHALT, AND TAR

2405. Addition of rubber powder and rubber to road-building bitumen. (In German.) — Steinhilber and — Schirott. *Bitumen, Teere, Asphalte, Peche*, 1957, **8** (5), 175–8.—Extensive investigations are described, with supporting tabula-

tions and curves, on the effect of additions to bitumen binders of pure unvulcanized rubber (Pulvatex), synthetic rubber (Rubarite), finest ground thread-free German rubber powder (rubber A), and fibrous German rubber powder (rubber B). Results show that rubber additions improve the properties of bitumen, also those of asphalt concrete produced with these binder mixtures. An important fact is that, with a large excess of binder, compression strength and breaking load of the coverings is retained or even increased. Bending and the time required to fracture the test pieces is increased, an indication that such coverings will be insensitive to crack formation, and increased binder quantity will ensure longer life. R. T.

2406. Soil consolidation with bituminous binders. Provisions, application, and requirements. (In German.) T. Temme. *Bitumen, Teere, Asphalte, Peche*, 1957, **8** (5), 164–70.—Foundation consolidation methods, partly from exceptional adaptability to present conditions, are discussed. The uniform nomenclature for foundation designation as given in DIN 4022 is discussed and reproduced in a table. Gravels, sands, and rock flour—varying little from the mother rocks—are used in road foundations. Rock flour has a high capillarity for water, leading to difficulties when present in large quantities; this may be corrected by bituminous binder additions. In contrast to gravel, sand, and rock flour granulations, which have definite grain sizes and relatively regular properties, silt and mud constituents of the foundation have distinctly changeable properties, dependent on factors other than granulation. Moisture has considerable influence, being present as free water or a water film firmly adhering to the foundation particles. The films held under great pressure can develop strong adhesive forces on the fine constituents and are great foundation stabilizers. This is true for their substitution by bituminous binder films. Density of the absorbed water film is regulated by the chem composition of the colloidal foundation constituents and nature of the ions absorbed on their surfaces. In bituminous foundation stabilizing the binder assumes the functions of adhesion and cohesion effect of the thin water film. Mechanical execution of stabilizing foundation mixtures and procedure are discussed with particular ref to Dr Oberbach's reproduced statements from *Bitumen*, 1933, **10**. R. T.

2407. Use of the phase-separation method for demineralizing Athabasca-bitumen-sand. (In German.) E. Weingaertner, K. Chandrashekaran, and K. S. Anantha Raman. *Erdöl u. Kohle*, 1957, **10**, 584–7.—Athabasca-bitumen-sand—*ca* 85% sand and 15% bitumen—covers a region *ca* 30,000 sq. miles and contains *ca* $15 \cdot 10^6$ tons of viscous bitumen. By the method described—kneading in a pug mill with peat, graphite, charcoal, or coke—the material is separated into two sharply defined fractions, a water–mineral-phase and a bitumen–coke (etc.)-phase containing the solids in the max possible enrichment. From all the mixtures, if fresh, the bitumen can be separated with benzene or light petrol. Mineral-free bitumen or mineral-lean solids are obtained extensively. In the case of graphite addition 97%, in the case of peat 94% of the total mineral matter in all raw materials is removed. With charcoal mineral separation is only 65%. A notable result is peat water reduction from 79 to 35%, which offers possibilities for a peat drying process. 7 refs. R. T.

2408. Sand-built reservoirs lined with asphalt. Anon. *Shell Bitumen Rev.*, 1958, **3**, 12.—Following the success of the first reservoir to be made in Britain with an impervious hot asphalt lining, two further reservoirs, each of 7 million gal capacity and 13 ft depth, were constructed. An 8-ft wide asphalt strip was used—following a 5% solution of weed killer—at the base and slope junction for easy transition from base to slope. The asphalt lining consisted of a base course laid and rolled to 2 in. min thickness, followed by a layer of sand carpet asphalt of 1 in. min consolidated thickness. The base course was a special mix containing 55% limestone aggregate, designed for max strength and impermeability. The sand carpet to BS 594 contained 12·5% bitumen. Exposed surfaces were coated with hot bitumen before applying asphalt. R. T.

2409. Dune revetement on the island of Texel. Anon. *Shell Bitumen Rev.*, 1958, **3**, 4–5.—Precautionary measures to protect Texel island include construction of an asphaltic dune revetement completed in 1956. At the dune foot is a fascine mattress with a reed base to make it impervious to sand and resistant to toredo attack. The revetement consists of an open asphaltic concrete layer with a superimposed dense asphaltic concrete. Asphaltic concrete ribs with a curb-paver along the revetement slope reduce wave uprush. A seal coat of cutback bitumen blinded with chippings finally covers the bituminous revetement. Compositions of bitumen mixes are given. R. T.

2410. Thermal degradation of low temperature tars. (In Czech.) S. Schongut and M. Sykora. *Chem. Prumysl.*, 1957, **7**, 581–7.—The author attempted to obtain ethylene by pyrolysis of tars and similar materials formed in the production of synthetic liq fuels by high pressure hydrogenation of tars derived from low temp carbonization of brown coal. It was concluded that valuable hydrocarbons could be obtained even when the tar residues are not over-heated. The deciding factor for the amount of gas (especially olefins) is the C/H ratio for the starting material, which can be modified if the latter is obtained from " acid oils " by caustic lye extraction. Primary tars are more suitable for pyrolysis than dist residues of hydrogenated tars. G. W. T.

SPECIAL HYDROCARBON PRODUCTS

2411. Electrical conductivity of liquid insulators at 0° C. Anon. *Elect. Times*, 1958, **134**, 301.—Brief summary of work by Guizonnier (*Rev. gén. Elect.*, 1956, **65**, 372; *Compt. rend.*, 1958, **264**, 397) giving conductivity curves (−30° to +30° C, heating and cooling) on No. of insulating liq (including benzene, trans oil, hexane, toluene, paraffin oil). Change of slope round 0° C confirms view that H_2O is main cause of conductivity (cf. Abs. **1829**, 1953). V. B.

COAL, SHALE, AND PEAT

2412. Fluid bed pretreatment of bituminous coals and lignite and direct hydrogenation of chars to pipeline gas. K. C. Channabasappa and H. R. Linden. *Industr. Engng Chem.*, 1958, **50** (4), 637–44.—Description is given of experiments performed in a small scale fluidized bed to discover the best coal pretreatment to give non-agglomerating reactive chars for fluid-bed hydrogenation to pipeline gas. Investigations were carried out in various atm at ordinary pressure, with max temp from 400° to 750° F. Optimum conditions were found to be pretreatment in air or nitrogen at 600° F for bituminous coals and 500° F for lignite. High yields of pipeline gas containing 70–80 mol % methane + ethane were obtained at 1350° F. Details of the apparatus and procedure used and of the hydrogenolysis characteristics of pretreated coal are given. D. K. R.

CORROSION

2413. Economics of underground corrosion control in Union Gas system. R. E. Kuster. *Pipe Line News*, Aug. 1958, **30** (8), 43–7.—After an unprotected pipe has been in a fairly corrosive soil for some years, a time comes when it is cheaper to recondition it or put down a new pipeline than to continue to maintain it fit for use. This is due to pitting of the pipe by corrosion. Details are presented of the economics of the Union Gas Co. Ltd's corrosion control system. The 500 miles of piping, bare and coated, were averaging a leak a mile prior to 1949, when an extensive cathodic protection scheme was introduced. The cost to date is $490,000, but an estimated saving has been achieved on leakage repairs and lost gas of $350,000, and the leakage rate is less than 50 for 1957. Examples using the " equivalent annual cost method " are used to show that, in spite of higher initial cost, a coated and cathodically protected line is more economical than a bare pipe with cathodic protection. D. K. R.

2414. Economics and justification of corrosion control. J. A. Holloway. *Pipe Line News*, July 1958, **30** (7), 52–4.—In corrosion the metal gives up electrons to cathodic areas. To prevent corrosion, this loss of electrons must be prevented. This may be done by insulating the pipe to prevent electrons leaving it—the applied coatings attempt this, but never fully succeed—or by pumping sufficient electrons into the pipe to raise the potential of the cathode to that of the anode, or corroding areas. This is termed cathodic protection. Examples are quoted showing that pipe coatings should be supplemented by cathodic protection to eliminate the danger of faults in the coating. It is economic to apply a good, high resistance coating when the line is first laid, as this will require less cathodic protection current than a poorer coating. As the coating resistance varies inversely with the pipeline area, a thick coating, or one of high resistance, should be used with large dia pipes. The installation of cathodic protection risers when a pipe is laid will save much of the cost of adding them later. D. K. R.

2415. Apparatus for the investigation of corrosion in moving liquids and strongly aggressive media. (In German.) V. Seifert *et al. Coll. Trav. Chim. Tchecosl.*, 1958, **23**, 557–9.—Up to the present, no completely reliable and satisfactory apparatus for measuring corrosion and corrosion resistance of metals and materials has been devised. This article describes an apparatus, its construction, and testing, which enables corrosion measurements to be made in strongly aggressive media, at varying temp, and at different rates of flow. G. W. T.

2416. The utilization of radioisotopes in the study of metallic corrosion in an alkaline medium. (In French.) H. Makram. *C.R. Acad. Sci., Paris*, 1958, **246**, 99–101.—In this method the sample of metal to be tested is irradiated in an atomic pile and then placed in the corrosive solution. It is then possible to determine the passage of marked ions into the solution; this is studied as a function of time. This method give a quantitative measure of corrosion. P. H. S.

2417. New system of cathodic protection. Anon. *Mot. Ship*, 1958, **39** (456), 85.—A trailing anode system of cathodic protection has been devised by the Koninklijke Rotterdamsche Lloyd WV.

An aluminium wire " anode " is trailed from the stern of the ship through which a low voltage current is passed. This " anode " is slowly sacrificed and in doing so protects the underwater hull. D. K.

2418. Cathodic protection for ships. Anon. *Mot. Ship*, 1957, **38** (448), 287.—There is an increasing use of cathodic protection in tankers, and promising reports are being obtained. The capital cost and potential economy is discussed. D. K.

ENGINES AND AUTOMOTIVE EQUIPMENT

2419. Influence of the homogeneity of the fuel–air mixture on the thermal efficiency of an automobile engine and on the carbon monoxide content. (In French.) H. Griffon *et al. C.R. Acad. Sci., Paris*, 1958, **246**, 3156.—Experiments were carried out on three different types of automobile engines, run for part of the time normally, and for part of the time with an additional mixing device inserted between the carburettor and the combustion chamber. It was found that in the latter case there was a significant reduction in the specific consumption with only a slight loss of power. There was also a considerable reduction in the carbon monoxide content of the exhaust gas. G. W. T.

2420. Use of exhaust gas for preparing the combustion phase in compression ignition engines. (In French.) R. Vichnievsky and G. Monnot. *C.R. Acad. Sci., Paris*, 1958, **247**, 48–50.—A double injection method for compression ignition engines is proposed, which allows the use of petrol in such engines. For the satisfactory working of compression ignition engines the fuel, in the form of a fine spray, must ignite readily on contact with hot, compressed air. Hydrocarbons with less than 14 carbon atoms in the molecule will not do this unless previously subjected to high temp and pressure. This may be achieved by injecting part of the charge at the end of the exhaust phase, the rest being injected in the normal way. P. H. S.

2421. The influence of lead on engine oils and its advantages over tin as a protective coating for pistons. (In German.) H. Kessler and H. Konig. *M.T.Z.*, 1958, **19**, 186–9.—Tests have indicated that the cat action of the protective coatings, contributing to acid formation and therefore to premature aging of lub oils, is not equally indicated in all engines. In four-stroke diesel engines, the risk is almost non-existent, whilst in two-stroke engines results differ considerably. It is therefore recommended that lead should not be used as a coating on the pistons of two-stroke engines subject to a heavy flow of oxygen, as in supercharged engines. G. W. T.

2422. Dynamometer for petroleum research. Anon. *Engineering*, 1958, **186**, 116–17.—English Electric equipment installed at Esso Research Ltd, Abingdon, comprises a swinging-frame dynamometer, an a.c. mains-connected motor generator set for absorbing dynamometer output and supplying a variable d.c. voltage for motoring the dynamometer, together with the associated interlocking controls. Characteristics of the dynamometer are shown graphically. It absorbs up to 150 h.p. at a max of 5000 rev/min, or 175 h.p. at 3000 rev/min for one hr. When motoring, the dynamometer and d.c. system provide *ca* 60% of the absorption ratings. G. W. T.

ECONOMICS AND MARKETING

2423. Oil in the U.K. C. Brunner. *J. Inst. Fuel*, 1958, **31** (205), 79.—Some of the problems likely to be encountered by the U.K. oil industry in the future are considered. Aspects particularly discussed are: the future energy picture; oil as a vital factor in the energy equation; economic considerations in the supply of oil; and availability of supplies. D. K.

2424. Heat and power for Western Europe. H. McNeil. *J. Inst. Fuel*, 1958, **31** (208), 198.—Some of the important factors affecting fuel requirements and the supply of fuel for the next 10–20 years are outlined. D. K.

2425. Fuel use and fuel economy in Italy. C. Padovani. *J. Inst. Fuel*, 1958, **31** (204), 18.—An outline is given of the evolution in demand and consumption of heat and energy in Italy since 1922. In spite of the development of hydroelectric power and natural gas sources, Italy still depends for more than 60% of her power consumption on imported fuels. The tendency is to import more crude fuel for processing in Italy and less finished products. Coal is being used less as a source of power, and natural gas and petroleum are replacing it. D. K.

2426. Bank loans on gasoline plants. F. E. McGonagill. *J. Petrol. Tech.*, 1958, **10** (2), 13–16.—Increasing demand for natural gasoline, butane, and propane has led to gasoline plants being installed in small fields where formerly they were not profitable. Often this has involved the raising of secured loans. The cost of the plant has little if anything to do with its income-producing capacity. It is therefore necessary to consider various factors: gas reserves and the producing rate; gas analyses; contracts for gas purchase; sales contracts for products and residue gas; plant cost and design; estimate of income and operating expenses.

The liq content of the gas may change over time. Product prices have varied widely, and depend on the area.

Lending institutions commonly think in terms of a max loan of 40–65% of the present value of the net cash recovery from the plant.

A summary is given of the economic forecast made in determining the loan value of a gasoline plant. G. D. H.

MISCELLANEOUS

2427. A Shell plunging engineer. Anon. *Shell Bitumen Rev.*, 1958, **3**, 8–10.—Exploratory tests of asphaltine mix, material, equipment, and formulæ required—following lab investigations—on grouting rubble mound foundations of a concrete wall several metres deep in water, are described. Sand mastic–composition sand 60%, filler 20%, Mexphalte 40/50 20% and density 2·12, was applied at 190° C under constant underwater observation with telephonic communication to the surface. A force of 25 tons was required to pull out two blocks, the third broke. R. T.

2428. Definitions in the mineral oil sphere. (In German.) Anon. *Erdöl u. Kohle*, 1957, **10**, 599–605.—A list of tech terms drawn up by the Technical Cttee for mineral oil and fuel standardization. R. T.

2429. The coal industry and fuel technology in the U.S.S.R. W. I. Jones. *J. Inst. Fuel*, 1958, **31** (208), 204.—This review is based partly on an examination of Soviet literature, partly on data published by delegations, and partly on the author's personal experience. Half the article is a discussion on the coal industry. The other aspects considered are oil and natural gas, hydroelectricity, nuclear energy, boilers and steam engineering, and education. D. K.

BOOK REVIEWS

The Structure of British Industry. A Symposium edited by Duncan Burn. Vol. I. London: Cambridge University Press, 1958. Pp. xvii + 403. 45*s*.

"The Structure of British Industry" is published for the National Institute of Economic and Social Research. The editor tells us in the introduction that it was inspired by a similar work on American industry by Professor Walter Adams.

It does not purport to cover the whole of British industry; subjects chosen relate to some 40% of British net manufacturing income, each chapter being devoted to one industry, contributed by an economist of standing.

The first volume deals with agriculture, building, road and rail transport, coal, oil, chemicals, steel, building materials, and machine tools. The second volume, not yet published at the time this review is written, covers motors, aircraft, shipbuilding, electronics, cotton and rayon textiles, woollens and worsted, man-made fibres, pottery, pharmaceuticals, and cutlery.

The emphasis is therefore on the domestic and manufacturing industries, so that petroleum with its international character stands somewhat apart, as the author is at pains to make clear. Mr Burn himself contributes the oil chapter and also that on steel.

The method of treatment is similar in each case so far as is possible with such differing industries. There is a review of the general organization, with tables showing the number of units—companies, factories, or, in the case of coal, the number of mines—with details of numbers employed, output, etc. This is followed by a lengthy discussion of the marketing side, price policies, and degree of monopoly involved. Some of these statistical tables are revealing; it is surprising, for example, to learn that in 1952 out of 1334 coal mines in the U.K., 455 employed less than 50 people, and in only three did the number of employees exceed 3000.

The petroleum chapter is the longest in the first volume, and nearly a quarter is devoted to a preliminary discussion of the world industry as a whole before the British segment is discussed. This seems a reasonable approach for a lucid explanation of such an international industry. Unavoidably in a book of this kind no figures are quoted later than 1956, which is rather more of a disadvantage in so rapidly developing an industry as oil than it probably is in some of the others discussed in the same volume.

On the subject of prices and competition in the petroleum industry, the writer acknowledges among his sources the F.T.C. report on "The International Petroleum Cartel"

and the E.C.E. report on "The Price of Oil in Western Europe." He does not, however, by any means accept their views uncritically. He observes that "The E.C.E. discussions seem to assume that because the Middle East oil price included a large profit it was possible to negotiate a lower price for a larger output; but this seems to underestimate the bargaining sense of the Middle East—illustrated constantly in the negotiations of new agreements since the war—and to assume that those who possessed cheap oil might shape their price policy to suit the convenience of Europe, when Europe thought of herself as short of oil. On the contrary, in this situation the United States prices may be of value as a ceiling."

In the final paragraph of the chapter he pays the industry the tribute of saying, "Over all and above all is a sense of responsibility to an expanding world."

This is a useful work of reference for administrators, journalists, trade unionists, and those other serious readers for whom it is intended. D. E. D.

Competition in Oil. The Gulf Coast Refinery Market 1925–1950. Daniel C. Hamilton. Harvard: University Press; London: Oxford University Press, 1958. Pp. 230. 60*s*.

This is an important and welcome book. Although it deals only with one sector and with one market (refining on the Gulf Coast and on the Eastern Seaboard of the U.S.A.), the sector chosen is frequently regarded as a key to the oil process, whilst the Gulf Coast is historically the largest and most influential refinery market in the world and still plays a crucial part in the determination of world price levels. A study in microcosm, therefore—and a careful, thorough, and able study at that—it is far from being without "macrocosmic" implications. It comes opportunely to hand for members of the IP, following upon the Summer Meeting, and the main chapters into which the book is divided—about the structure of the market, conditions of entry, price/output behaviour, other aspects, *e.g.* progressiveness—suggest that in arranging his material the author has had much in mind those formal conditions of "perfect competition" which Mr Andrews outlined and criticized on that occasion. The overall conclusion reached is that "the Gulf Coast refinery market is certainly not the epitome of pure competition, and our evidence concerning both its structure and its performance is far from complete. On the other hand, the available evidence does seem to suggest a persistent downward pressure on processing costs and margins and the market structure which has produced this behaviour does seem to fall towards the competitive end of most writers' scales."

The content of the book may be conveyed in more detail by itemizing the author's conclusions on the aspects mentioned above.

Structure: Despite extensive vertical integration, separate and substantial markets exist for both crude and products, and independent refining on a sizeable scale is therefore possible. In terms of refining capacity, the market is characterized by moderate but persistent oligopoly. Although the volume of transactions which take place "within" integrated systems probably exceeds the volume of sales on the market "there is no *a priori* reason to think that average prices would be very different if the total output of Gulf and East Coast refineries passed over the market mechanism."

Conditions of Entry: Entry is largely free from artificial restraints, but the size of the capital resources required to set up and remain in refining constitutes a formidable economic barrier. While "persistent and flagrant monopolistic behaviour is therefore unlikely, the threat of an influx of new entrants constitutes no very great deterrent to monopolistic action." The author goes on to make the very interesting observation that "the aggressive independence of existing firms" seems the factor most likely to ensure "a tolerably persistent pattern of competitive conduct."

Price/Output Behaviour: Outstanding features in the short run are stability of crude runs, seasonal oscillation of total inventories, and instability of the refiners' margin. Over the longer term the margin continues to fluctuate more widely than crude runs (or inventories). These features are to be explained by reference to the importance of overheads, as a result of which total unit costs rise rapidly as output is reduced. The individual refiner is therefore under pressure to shade prices in order to stimulate sales as crude runs are cut back. There seems to be no persistent and purposeful discrimination in price, *e.g.* between domestic and export sales, or between products.

Other Aspect of Performance: 75 per cent of total capacity in 1950 consisted of plants of about optimum size (3–5 million tons p.a.). Little evidence of any considerable, chronic, excess capacity was found. Both these features may be said at least to point away from lack of competition in the market. Further, frequent innovations, widely adopted, have made possible a broadening of the range of products and an improvement in product qualities at a slight decline in prices. This argues scope for profitable independent action.

The broad conclusion to which this analysis leads—that the Gulf Coast market is, at the lowest estimate, more competitive than not—has already been mentioned. Mr Hamilton comes to this opinion only after reviewing the data in the light of criteria other than (but as well as) those which the theory of perfect competition provides. Most readers will find this last chapter, in which reference is made to the views of modern American economists, the stiffest. Besides the footnotes the extensive bibliography gives a clear indication of the many shades of opinion which the author has considered as well as the broad factual foundations on which the study as a whole rests. A surprising omission from so inclusive a list is the Report of the Brookings Institution on "Big Business in a Competitive Society." This would seem very relevant to the considerations of the final chapter, and its emphasis on *choice* (in all its ramifications) as the essence and outcome of competition might have enabled Mr Hamilton, had he regarded it, to embrace his final views just a shade more exuberantly. A. F. P.

Electron Impact Phenomena and the Properties of Gaseous Ions. F. H. Field and J. L. Franklin. New York: Academic Press Inc., 1957. Pp. ix + 349. $8.50.

This book is rather more specialized than might appear from its main title, since it is entirely concerned with the ionization and dissociation of gaseous molecules by electrons of energies up to a few hundred electron volts, and in particular with the appearance potentials of gaseous ions, the energetic quantities derivable from them, and mass spectra. There has been a large number of investigations in this field over the past twenty years, but the information has been available only in original papers or reviews of limited scope, and this excellent and comprehensive review should prove most valuable not only to workers in the field, but also as an introduction for physical chemists in general to this approach to the measurement of ionization potentials and bond energies.

The book begins with a description of the experimental techniques used in measuring critical potentials with the aid of mass spectrometers, and the precautions necessary in obtaining reliable results are emphasized. The theoretical chapter which follows includes a full discussion of the

factors which complicate the interpretation of the experimental data, such as the possibility that the products of ionization may possess kinetic or excitation energy.

Values of ionization potentials, heats of formation of radicals and ions, and bond energies which have been obtained by electron impact methods are compiled and critically discussed. In many cases where the evidence is conflicting, both sides of the argument are well presented.

In the chapter on mass spectra, the many trends and regularities which can be traced in the mass spectra of homologous series of molecules are well summarized, and sections are devoted to detailed features of mass spectra such as metastable ions, rearrangement, temperature coefficients, and the effect of isotopic substitution. Such theoretical explanations as exist are given, though in view of the large amount of data which exists surprisingly little progress has been made towards a complete theoretical explanation of mass spectra, of the kind which would enable the mass spectrum of a complex molecule to be predicted. The most successful theory in this respect, the so-called quasi-equilibrium theory, receives much attention throughout the book.

The possibility that the properties of gaseous ions may help to elucidate the mechanism of ionic reactions in condensed phases is considered in the final chapter.

The book as a whole is well written and indexed, and admirable in its presentation. Much of the data is presented in tabular form, and one of the most useful features is a complete table, with references, of all the values of appearance potentials of both positive and negative ions published since 1930. Over 500 references are listed.

R. M. E.

Recent Advances in Petroleum Chemistry and Refining. Vol. I. Ed. Kenneth A. Kobe and John J. McKetta, Jr. New York, London: Interscience Publishers Inc., 1958. Pp. xv + 641. $13.50.

This book is the first volume of a series whose aim, as simply stated in the introduction, is to record the advances being made in the petroleum industry. The series is intended to cover not only developments in the conventional refining of crude oil to produce the fuels and lubricants required to-day and in the foreseeable future, but also developments in the large and rapidly expanding petroleum chemicals industry.

To achieve this ambitious task the whole field has been divided into five main groups, whose standard order for the series is:

Group I.	Economics and Future Trends
Group II.	Unit Operations and Design
Group III.	Refining Processes
Group IV.	Petrochemicals
Group V.	Mechanical Equipment

It is intended that a number of progress reports written by experts on chosen subjects within each main group will appear in a series of volumes to be published at approximately annual intervals. As there will be chapters belonging to all five groups in each volume, the series should, after a few years, establish a comprehensive reference book on the petroleum industry.

In this first volume there are 12 chapters contributed by 21 American authors drawn from petroleum companies and process engineering contractors for the oil industry. Each chapter is in the form of a review article in which the available information on the chosen subjects is critically evaluated. Extensive references are given to the original literature and to many American and British patents covering up to early 1957.

The introductory chapter in Group I deals comprehensively with the economic structure and scope of operations of the domestic American petroleum industry. This is followed by a brief but lucid account of "Present and Future Sources and Compositions," in which the increasing emphasis on chemical composition rather than physical properties of crude oil is brought out. The final chapter in this section, "Fuel Trends," covers present and predictable requirements for both quality and quantity of distillate fuels on a world-wide basis.

The longest section of the book is Group II, Unit Operations and Design, containing chapters on "Separation and Purification by Crystallization," "Superfractionation, Azeotropic, and Extractive Distillations," and "New Fractionating Tray Designs." At first sight it seems paradoxical that the longest chapter deals with crystallization, a separation method not frequently used on a large scale in the petroleum industry, but the importance of *p*-xylene and the potential applications of this technique in the petroleum chemicals industry justify its inclusion, especially as it appears that, for difficult separations, crystallization processes may in future be available which are economically comparable with extraction or extractive distillation. The two chapters on distillation both contain valuable examples worked through step by step to illustrate design methods, a feature which will be particularly appreciated by those specializing in other fields who wish to follow these developments. It is regrettable that lack of published data on performance of the newer types of trays prevent their characteristics being examined in the detailed manner used for bubble-cap and sieve trays, but indications of their probable performance are provided.

Refining processes are represented by "Alkylation of Paraffins," "Catalytic Reforming," and "Solvent Refining," and the section on petrochemicals deals with "The OXO Process" and "Solid Polymers from Surface Catalysts." The treatment of alkylation is entirely theoretical. Practical applications of the process will be given in a subsequent volume of the series. The other chapters are entirely self-contained and of a standard seldom excelled.

The final section, Mechanical Equipment, contains one chapter describing present and possible future developments in petrol and diesel engines and the potentialities of the gas turbine and free-piston engine as power plants. The emphasis is mainly on the future, and as the potential fuel requirements of such engines are discussed in the chapter on Fuel Trends, a shortened section on the engineering aspects might have been also included there, and this section devoted to mechanical equipment actually in use in the petroleum industry, *e.g.* heating and cooling equipment. Doubtless such topics will be covered in future volumes.

The editing of the work has been very carefully carried out, the presentation is attractive, and diagrams are well set out and easy to follow.

One of the main purposes of the series is to provide a work by which specialists within one field in the industry can keep themselves informed of progress in others. In this purpose it succeeds admirably and can be wholeheartedly recommended both to practising petroleum technologists and to students of chemistry and chemical engineering.

Future volumes will be awaited with interest.

A. J. B.

Volume Requirements for Air and Gas Drilling. R. R. Angel. Houston, Texas: Gulf Publishing Company, 1958. Pp. 79. $3.00.

A study of circulation rates required for air and gas drilling, *i.e.* the minimum rates necessary to produce velocities in the bottom of the annulus equivalent in lifting power to a standard air velocity of 3000 ft/min.

Each curve gives air or gas requirements *v.* depth for a certain drilling rate. Data is given for gas gravities of 1·0 (air), 0·8, and 0·6.

The book is in handy pocket-size ($5\frac{1}{2} \times 8$ in.) and each of the 87 charts has five easy-to-read curves for drilling rates of 0, 30, 60, 90, and 120 ft/hr.

Oil—from Prospect to Pipeline. Robert V. Wheeler and Maurine Whited. Houston, Texas: Gulf Publishing Company, 1958. 132 pages. $2.95.

A guide for the student or layman to the technicalities of the oil industry, the first three chapters outlining in simple language the operations involved in finding and producing oil. Then follows a chapter on the ownership of oil rights in the U.S.A. and one on the economics of oil investments. Chapter 6 is entitled " Pride, Participate, or Promote," and the last two chapters give respectively a dictionary of oil terms and a list of abbreviations used in oil reports.

Keys to Successful Competitive Drilling. Roy A. Bobo, Robert S. Hoch, Geo. S. Boudreaux, and R. R. Angel. Houston, Texas: Gulf Publishing Co., 1958. Pp. 134 + ix. $5.50.

A practical handbook on rotary drilling with the emphasis on bit performance, an important and basic factor in drilling economics. Various aspects of rock bit design and performance are discussed, as well as circulation systems and hydraulics.

The book is well illustrated and has many charts and graphs to show the effect of variable factors on drilling procedure. Additional charts and monographs are also included on folded sheets contained in an envelope attached to the back cover.

This book should be of considerable usefulness to the practical driller.

Recommended Methods for the Analysis of Trade Effluents. London: The Society for Analytical Chemistry, 1958. Pp. 124 + xii. £2 2*s*.

Prepared by a Joint Committee of the Association of British Chemical Manufacturers and of the Society for Analytical Chemistry, this book arose from the need that all concerned with the examination of trade effluents should, as far as possible, use the same methods.

Dealing first with the sampling procedure, methods of analysis are then dealt with under four main headings: preliminary examination, oxygen demand, metallic contaminants, and non-metallic contaminants. The subdivision under synthetic detergents gives methods for anionic, cationic, and non-ionic detergents, and also one for anion- and cation-active substances in admixture.

Physical and Azeotropic Data. G. Claxton. London: National Benzole Association, 1958. Pp. 146 + v. £2 2*s*. (post 1*s*. 6*d*.).

Physical and azeotropic data for approximately 1800 hydrocarbons and sulphur compounds boiling below 200° C. The physical data given are melting point, boiling point, density, and refractive index.